

Ian Plimer's 'Heaven + Earth' — Checking the Claims

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Overview

Ian Plimer's book, *Heaven + Earth — Global Warming: The Missing Science*, claims to demolish the theory of human-induced global warming due to the release of CO₂ and other greenhouse gases. Overall:

- it has numerous internal inconsistencies;
- in spite of the extensive referencing, key data are unattributed and the content of references is often mis-quoted.

Most importantly, Ian Plimer fails to establish his claim that the human influence on climate can be ignored, relative to natural variations.

Ian Plimer's claim that the human influence on climate can be ignored, relative to natural variations, seems to rest on three main strands of argument:

- a:** the extent of natural variability is larger than considered in 'mainstream' analyses;
- b:** changes in radiative forcing from greenhouse gases have less effect than determined in 'mainstream' analyses;
- c:** the IPCC uses a range of misrepresentations to conceal points **a** and **b**.

Among the many errors made in attempting to establish these claims, are cases where Plimer:

- misrepresents the content of IPCC reports on at least 15 occasions as well as misrepresenting the operation of the IPCC and the authorship of IPCC reports;
- has at least 28 other instances of misrepresenting the content of cited sources;
- has at least 2 graphs where checks show that the original is a plot of something other than what Plimer claims and many others where data are misrepresented;
- has at least 10 cases of misrepresenting data records in addition to some instances (included in the total above) of misrepresenting data from cited source.

Details of these various types of flaw can be obtained via the relevant entries in the index.

A guide to how readers can independently check my claims is given on page 55.

Breadth of Science

In Plimer's public appearances he has made the claim that climate scientists are ignoring geology. This is untrue. Some of the geologists who are important in developing understanding of climate and climate change have been:

- Högbom – who worked with Arrhenius;
- Eric Sundquist of the USGS (with Sarmiento, resolved carbon budget ambiguity);
- the many geologists who have contributed to the paleo-climate studies that Plimer misrepresents;
- Henry Pollack, a borehole specialist, who has published an excellent book, *Uncertain Science ... Uncertain World*, (CUP), pointing out that uncertainty about climate is much less than the uncertainty surrounding many other important decisions;
- the American Geophysical Union which covers the gamut of Earth sciences – atmospheric, oceanic, solid earth, space sciences and most recently biogeochemistry — has strongly endorsed the reality of human-induced global warming:
http://www.agu.org/outreach/science_policy/positions/climate_change2008.shtml
- Similarly, the Geological Society of Australia put out a position statement on greenhouse gases and climate change. It noted *the well-documented loading of carbon dioxide (CO₂) to the atmosphere, which has been linked unequivocally to burning of fossil fuels, and the corresponding increase in average global temperature*. It made recommendations about the role of geology in climate science. It can be found at:
http://www.gsa.org.au/pdfdocuments/management/GreenhouseGasEmissions&ClimateChange_GSAPositionStatement_July2009.pdf

Point by point

This list has been evolving, in part due to input from colleagues. The items are listed in order of pages in *Heaven + Earth* and the page noted — the item numbering is changing as the document is extended. An index for various topics is given, identifying both the item number and the page in the present document. If you wish to quote items here, quote using the page number in *Heaven + Earth*.¹ Better still, don't quote me at all — use this document as a guide to check it out for yourself, even if you have to resort to buying the book. In cases where colleagues have advised me of flaws in the book, this is acknowledged by noting initials after the particular item. The acknowledgements section below identifies those involved. Material that is underlined is presented as an exact quote from *Heaven + Earth*, except that Plimer's footnote references have only been retained when they are important for indicating misrepresentation of cited sources. When I refer to 'footnotes' or 'references' this means Plimer's footnotes not mine, unless I explicitly indicate otherwise.²

¹Page numbers and reference numbers refer to the Australian edition. I have not (as of March 23, 2011) been able to establish whether these also apply to American and UK editions.

²There are no explicit references to my own footnotes in versions through to 2.2.

1. In spite of Plimer being praised for the extensive referencing, many of the controversial assertions have no supporting citation. These include: the claim that analysis of 102 studies showed that 78% found earlier periods, lasting at least 50 years, that were warmer than any period in the 20th century [page 86]; frequent claims that the Medieval Warm Period was 2 to 3 degrees warmer than the present and the claim that Roman times were 2 to 6 degrees warmer. (for which many of the cited references do not even address the Roman or Medieval periods — see overview on page 43 onwards); and the repeated claim that the climate sensitivity is 0.5°C.
2. In his efforts to down-play the extent of warming from CO₂, and exaggerate the relative role of water vapour, Plimer ends up implicitly attributing so much warming to water vapour, that the planetary temperature in the absence of water vapour would be nearer the temperatures of the outer planets. In some cases the numbers given by Plimer are exaggerated to such an extent as to imply that without water vapour, Earth's temperature would be below absolute zero — a physical impossibility. The exaggerations fall into two groups: those that relate to anthropogenic CO₂ and those that relate to total CO₂. In each case, inconsistency arises when the exaggeration in the relative proportions is combined with values for absolute warming.

i: exaggerations concerning anthropogenic CO₂:

The implications of the claim that *CO₂ derived from human activity produces 0.1% of global warming* is analysed in item 101.

ii: exaggerations concerning total CO₂:

The inconsistency in attributing 18°C of warming to total CO₂ [page 366] while stating in the caption of figure 44: *About 98% of the greenhouse effect in the atmosphere is due to water vapour*, is noted in item 70.

3. A large fraction of the graphics are given without any attribution of the sources of the data. Figures 2, 22, 36, 41, 43, 45 are schematics, where a citation is not needed, unless to acknowledge authorship by others (e.g. Figure 45 should be acknowledged as a minor variant from Figure 1.2 in the IPCC TAR (WG1 report), or preferably by referring to the Keihl and Trenberth reference cited therein). Figures 6, 7, 14, 17, 30, 32, 33, 35, 46, 47, 53 do include explicit citations while in figures 4, 19, 27, 28, 34, 38, 39, 40, 42, 48, 49, 51, 54 relevant data might be traceable by those with a reasonably good knowledge of the relevant field (e.g. when there is a unique data set held in an established central data repository).

Appropriate citations should be either for the graphic as a whole or for the data sets that are plotted (or both). Cases where neither of these is done are figures 1, 3, 5, 8, 9, 10, 11 (particularly for lower part), 12, 13, 15, 16, 18, 20, 21, 23, 24, 25, 26, 27, 29, 31, 37, 42, 44, 50 and 52. Problems with axis labelling (wrong numbers, missing numbers, incorrect labels) occur in figures 5 [item 16], 8 [item 17], 12 [item 35] and 14 [item 37]. (For comparison, the comparable issues with graphics in *An Inconvenient Truth* are a totally unquantified graph on page 89, no units on the plot on pages 78–79, and no temperature scale for the lower line on pages 66–67.)³

³Comments on *An Inconvenient Truth* refer to the book unless otherwise indicated.

4. In general the graphics are poorly linked to the text, with the text making no explicit mention of the graphics in virtually all cases. Apart from the issues of lack of citations and mislabelling of axes, noted in item 3, there are significant problems with the content of many of the graphs. By figure number, these are:
 - 1:** Misrepresents the HadCRUT data set and uses fabricated data for 2008 — [see item 6].
 - 3:** The data are distorted — [see item 13].
 - 5:** Falsified time axis, thus giving no indication of the Younger Dryas, in contradiction with text — [see item 16].
 - 10:** Lack of specifics makes the plot meaningless — [see item 18].
 - 11 (upper):** ‘Hockey stick’ data have been distorted — [see item 31].
 - 11 (lower):** values for 20th century have been distorted, end of MWP inconsistent with abrupt end described in text — [see item 31].
 - 14:** While a citation is given, comparison with the cited source shows that one of the curves is not what Plimer claims it to be [see item 37].
 - 15:** Time series truncated to shift relative degrees of correlation — [see item 39].
 - 29:** The content is misrepresented — [see item 54].
 - 38, 39, 40:** Plotted on different scales to support the assertion that different time-averaging leads to different trends (an assertion that violates the basic laws of arithmetic) — [see item 65].
5. In analysing the details that follow, remember that *Heaven + Earth* is being promoted⁴ as a scrupulous and scholarly analysis.
6. p. 11, figure 1⁵: This graphic has several misrepresentations. The bold line purports to be temperature data from the HadCRUT data set (see page 41 below). This is not true. The HadCRUT data are closer to the lighter solid line which is labelled, *UAH LT (adj to Sfc)*.⁶ More seriously, at least for the HADCRU data⁷, the 2008 data that are shown are fabrications. The HadCRUT data set shows 2008 as being only 0.081°C lower than 2007 — [BB].
7. p. 21: (referring to Ben Santer) The lead author then added references to his own work which showed warming from 1943 to 1970.¹⁷ However, when a full set of data from 1905 to after 1970 was analysed by others, no warming was seen.¹⁸ Here Plimer is misunderstanding the argument and misrepresenting both sides.
 - i:** The argument is not about warming per se, but mainly about the stratosphere-troposphere temperature difference as an indicator that the mechanism identified by Arrhenius is operative, and the corresponding pattern of temperature change from aerosols;
 - ii:** Reference 17 refers to the period 1963 to 1987, not 1943 to 1970 as claimed by Plimer. This misrepresentation falsely implies that Santer et al were claiming warming at a time of relative cooling.
 - iii:** Reference 18 (by Michaels and Knappenberger) analyses the period 1958 to 1995,

⁴Cover ‘blurb’ by Lord Lawson of Blaby, on paperback edition.

⁵Until version 2.0, this was incorrectly noted as figure 11.

⁶Presumably: University of Alabama Huntsville, Lower Troposphere (adjusted to surface).

⁷See page 41.

not the period from 1905 onwards. The primary claim by Michaels and Knappenberger was that Santer et al. were cherry-picking by choosing a start-date around the time of cooling from the eruption of Mt. Agung. An additional criticism published following reference 18 made similar comments suggested that the role of ozone depletion had been neglected. Immediately following this was the response by Santer et al. noting that both these comments used a questionable data set.

8. p. 21–22: Biased comparison of IPCC ‘**balance of evidence**’ vs a survey that found only 10% of scientists **certain** that global warming is a process that is underway.
9. p. 22: asserts that during the Medieval Warming, the global temperature was a few degrees warmer than today. This claim is asserted in various forms at many places through *Heaven + Earth*, mostly without any justifying citation. Many examples of changes for various regions are noted with citations, but there is no analysis of the overall results. The main places where the claim for a large and widespread Medieval warming is backed with citations are on page 63 [citing footnote 239] and page 490 [citing footnotes 2282 and 2283]. As noted in item 21, reference 239⁸ shows only a single time series for temperature. Item 123 notes that reference 2282 makes no mention of the MWP and reference 2283 (the first IPCC report) contains only a schematic with no temperature scale assigned. Similarly, item 23 notes that reference 255, cited in support of 2°C cooling from MWP to LIA only analyses the period 20,000 BP to 10,000 BP.
10. p. 22: Misrepresents IPCC treatment of Little Ice Age (LIA), Medieval Warm Period (MWP). (See later — item 32).
11. p. 22: Referring to the ‘hockey stick’ in the 2001 IPCC WG1 report: It was highlighted on the first page of the Summary for Policymakers and was shown another four times in the 2001 Summary for Policymakers. Since there are only five figures in the 2001 WG1 SPM, this would imply that all figures in the SPM include the ‘hockey stick’. This is quite simply false.
12. p. 22: The IPCC, without explanation, quietly withdrew the “hockey stick” from the Summary for Policymakers in subsequent publications and had it buried in a scientific chapter of the 2007 report. with the footnote 24 noting as one of the reconstructions of past climate. The reconstructions, including that from Mann et al., are also in the technical summary (figure TS.20) of the 2007 report — [DK].
13. p. 25, figure 3: The graph has been distorted and misplotted. The line has the 1998 peak in about the right place relative to the scale, but the 1940 peak (labelled as such) appears in the 1950’s and the 1975 trough is plotted nearer to 1979. (The Brave New Climate web site identifies this fabrication as coming from *The Great Global Warming Swindle*).
14. p. 25: There is no problem with global warming. It stopped in 1998. The last two years of global cooling have erased nearly thirty years of temperature increase. The last 30 years of temperature increase have not been erased. The HADCRU data set⁹ shows that

⁸Version 1.6 incorrectly referred to reference 9 at this point.

⁹File hadcru3gl.txt, see description on page 41.

both 2007 and 2008 have annual temperatures higher than any year prior to 1997 in the instrumental record.

15. p. 32: within a glacial period that has already lasted tens of millions of years, identified in footnote 38 as Pleistocene glaciation, sometimes called the Quaternary glaciation — implying a tens of millions of years duration for the ‘Pleistocene’ and ‘Quaternary’ that might surprise Plimer’s geological colleagues.
16. p. 33, figure 5: Caption reads: The amount of temperature and temperature change This is two different things, but only one line is plotted. In addition, this unattributed graphic lacks any indication of the rapid cooling and warming associated with the beginning and end of the Younger Dryas [c.f. pages 42–44 and figure 10)]. Since the graph extends to the point labelled Today at 2000 on the time-scale, the description Time (years ago) is incorrect. However,¹⁰ comparisons with other publications indicates that this is rates of change from the GISP-2 ice core. However, in the ‘original’ graphic the time-scale was non-linear (possibly linear in depth), and the linear time-scale has been imposed by Plimer (with, as noted, the endpoint being inconsistent with the labelling). This is one of the weirder cases of distorted graphics since Plimer’s falsification of the time axis acts counter to his argument by removing the changes around the Younger Dryas.
17. p. 40, figure 8: lower part lacks numbers on horizontal axis.
18. p. 43, figure 10: The plot of ice accumulation is meaningless without saying where. Clearly, 0.2 metres/year for the last 10,000 years is not a global average.
19. p. 59: In the section on The Roman Warming Plimer states Temperatures in the Roman warming were 2 to 6°C warmer than today. As discussed in the subsection ‘Roman Warming’ below (page 44), **none** of the scientific papers cited in this section of *Heaven + Earth* present evidence of such warming anywhere on earth.
20. p. 59: Plimer goes on to say By 300 AD, the global climate was far warmer than at present.²¹⁷ Reference 217 is a 1977 book by H. H. Lamb which says little about Roman times. The strongest statement seems to be on page 4 saying that By late Roman times, particularly in the fourth century AD, it may well have been warmer than now, with ‘now’ meaning the mid 1970s.
21. p. 63: In the Medieval warming, it was far warmer than the present and the warming was widespread.²³⁹ The citation for this (reference 239) is the book: *The Little Ice Age*. The index identifies four references to the MWP. One is a passing reference, one refers to sea level and one notes a subsequent cooling of 0.7°C to 1500. The most detailed discussion is on page 376 which presents only one time series of temperature estimates — 1000 years from central England. In addition, proxy series from Greenland and North America are shown without any temperature calibration, and combined into a ‘North Atlantic index’ again without any temperature scale assigned. Further discussion of Plimer’s lack of evidence is given on page 45.

¹⁰Clarification added in version 1.9.

22. p. 63–64: Reference 240 [Broecker, 2001] is an overview rather than a detailed analysis of particular temperatures. Plimer cites it in respect of California *enjoying warm times*²⁴⁰. The actual words in Broecker’s paper are *late in the Medieval Warm Period, California experienced several decade-long periods of profound drought*. (Broecker is citing [Stine, 1994], Plimer’s reference 283.)
23. p. 66: *Boreholes give accurate temperature histories for about 1000 years into the past because rock conducts past surface temperatures downward only slowly. In the Northern Hemisphere, borehole data shows the Medieval Warming and a cooling of about 2° C from the Medieval Warming to the Little Ice Age.*²⁵⁵ — comparison with reference 255, a paper by Steig et al., reveals multiple misrepresentations by Plimer:
- i:** the paper refers to data from a core extracted from ice, not a hole drilled into rock;
 - ii:** the ice core is from the southern hemisphere, not the northern hemisphere;
 - iii:** the paper does not analyse the Medieval Warm Period. All data plots refer to the period from 20,000 BP to 10,000 BP — there appears to be absolutely no discussion of the Medieval period.
24. p. 66–67: *A study of 6000 bore holes on all continents has shown that temperature in the Medieval Warm Period was warmer than today and that the temperature fell 0.2 to 0.7° C during the Little Ice Age.*²⁵⁶ The cited reference (footnote 256) actually says that *temperature declined until about 200 years ago, reaching a minimum of about 0.2–0.7 K below present-day*. (i.e. the 0.2 to 0.7 K is the amount of offset from ‘present-day’, not the amount of fall from the MWP). The words that Plimer completely ignores are in the preceding passage, saying (relative to the period 1300–1600 BP): *A warming followed, yielding temperatures that averaged 0.1–0.5 K above present-day in the interval 500–1000 years ago*. The reference does not specify the time interval that represents ‘present-day’, but this global-scale estimate clearly differs from Plimer’s repeated unsubstantiated assertion that the MWP was 2 to 3 degrees warmer than present. A later paper (by the authors of reference 256) *A late Quaternary climate reconstruction based on borehole heat flux data, borehole temperatures data and the instrumental record*. in *Geophysical Research Letters*, **35**, L13703 (2008) states *As the authors of HPS97 we can be criticized for not stating explicitly in HPS97 that the ‘present’ (the zero on the time axis) really represents something like the end of the 19th century, rather than the end of the 20th century*. The range of reconstructions in the 2008 paper, show a peak warming between 500 and 800 years ago, whose peaks, relative to to 1961–1990 mean, range from about -0.4°C to 0.3°C.¹¹
25. p. 70: *The Ontario forests have ... not returned to the diversity and productivity of the Medieval warming*²⁸¹. Indeed — reference 281, [Campbell and McAndrews, 1993], notes that *the wild forest of Southern Ontario, now largely cleared, is no longer a major carbon reserve ...*
26. p. 87: Plimer correctly quotes reference 368 [Royer et al., 2007] as saying *climate sensitivity greater than 1.5° C has been a robust feature of the Earth’s climate over the last 420*

¹¹The main issue here is that Plimer misrepresents reference 256, not that he failed to appreciate the significance of the upper 100 metres of data not being used.

millions years³⁶⁸. This is in accord with mainstream climate science and **totally contradicts the main thrust of Plimer's book**. (Repeated on p426 citing the same reference as number 2140).

27. p. 87: *If it is acknowledged that there have been rapid large climate changes in the past, then human production of CO₂ cannot be the major driver for climate change.* This makes the false assumption that there is an either/or choice between human and natural causes that applies at all times and on all time-scales.
28. p. 87: The 'Hockey Stick' temperature reconstruction by Mann et al. has come under intense criticism and Plimer repeats much of this in the section **The long tale of the lone pine**, attacking the [Mann et al., 1998] paper (footnotes 369 and 372) and repeatedly calling Mann et al. 'fraudulent'. What is surprising is that all this invective is focused on the wrong paper — [Mann et al., 1998] is not the source of the data used in the IPCC 'hockey stick' plots. Mann et al. [1998] is a global analysis (c.f. northern hemisphere in IPCC report) and only covers 600 years (c.f. 1000 years in IPCC report). It appears that *Heaven + Earth* never actually cites the 1999 Mann et al. hockey stick paper.
29. p. 87: *In the IPCC Second Assessment Summary for Policy Makers in 1996, a diagram showing the past 1000 years of Earth temperatures from tree rings, ice cores and thermometers showed the Medieval Warm period, the Little Ice Age and the Late 20th Century Warming.* The SAR SPM does not include **any** diagrams. The temperature reconstruction in the *Technical Summary* of the SAR only goes back to 1400.
30. p. 88: Essentially repeats (in a slightly less specific form) the earlier false claim (on page 22) that 'hockey stick' occurs a total of 5 times in the IPCC 2001 SPM, [see item 11] — [DK].
31. p. 89, figure 11:¹² In the upper part, the 'hockey stick' curve has been displaced upward relative to the version shown in the 2001 IPCC report, in spite of claiming to be the same reference period and having the 1998 instrumental values the same. In the lower part of figure 11, the depiction of the Medieval Warm Period is inconsistent with the claim on page 128 that *The Wolf minimum heralded the end of the Medieval Warming and the beginning of the 600 year Little Ice Age. It took only 23 years to change from a warm climate to a cool climate.* In addition the 20th century temperature data have been falsified by showing the 2000 temperature as almost exactly the same as the peak circa 1940 rather than 0.6°C higher.
32. p. 91: This makes a succession of claims about IPCC treatment of the Medieval Warm Period (MWP) , Little Ice Age (LIA) and hockey stick:
 - i: the 1996 IPCC report showed the Medieval Warm Period and the Little Ice Age
 - ii: Mann's "hockey stick" was used in the IPCC's 2001 report and the Medieval Warm Period and the Little Ice Age were expunged
 - iii: In the next IPCC report the Medieval Warm Period and the Little Ice Age mysteriously re-appeared (i.e. the 2007 report).

¹²Prior to version 1.7, the page was incorrectly given as 99.

In reality, the only reconstruction in the 1996 report appears to be the Bradley estimates (figure 10 in the technical summary, reappearing with thermometer measurements superimposed as figure 3.20, page 175 in WG1 SAR) which only went back to 1400 (i.e. after Plimer's definition of the end of the MWP). (Figure 3.21 shows proxies without any temperature relation and with poor coherence around the time of the MWP). Thus the MWP was not in the 1996 report to be 'expunged' in 2001. The 'reappearance' in 2007 is to have multiple reconstructions, none of which show a MWP even 1°C warmer than the second half of the twentieth century, let alone the 2°C that Plimer claims. The LIA can be seen in all 3 reports, with most reconstructions suggesting about 0.5°C below mid 20th century levels. In the 2007 report, a small number of reconstructions suggest LIA temperatures nearer to 1°C cooler and MWP a few tenths of a degree cooler. (Note that all this refers to the northern hemisphere).

33. p. 98: The GISS director³⁹⁸ claimed that nine of the ten warmest years in history have occurred since 1995, ... Since reference 398 is a paper published in 1999, the misrepresentation is obvious.
34. p. 99: Following soon after the previous passage ... NASA had to reverse its position ... NASA now states that the top four years of high temperatures are from the 1930s (1934, 1931, 1938 and 1939). The warmest year was 1934. Shortly afterwards: Similarly the UK's Meteorological office has now confirmed a fall in global temperatures. ... Nowhere in this discussion of global temperatures is the acknowledgement that interpolation about the high temperatures in the 1930s (the subject of the NASA revision to statements about extremes) refers to the USA and not the whole world. The revision to the USA data changes the global numbers by a few thousandths of a degree. ¹³ — [also in TL list].
35. p. 110, figure 12: The lower plot on this figure has a label referring to late twentieth century warming, with a time line in 'years before present'. However the line ends at about 60 years ago. Maybe Plimer is anticipating the book being in print, without revision in 2060! However the real howler in this plot is that the temperature increase is shown as about 40°C. In addition, the relation between upper (10000 years of C-14) and lower (1100 years of temperature) parts of the figure is unclear.
36. p. 121: the sun rotates around the centre of gravity of the solar system about every 11.1 years. Plimer is confusing rotation (about once every 25 days) with orbital motion around the center of gravity. According to Einstein's principle of general relativity, such orbital motion can have no detectable effect. There can be tidal effects, but these will have a frequency given by the difference: $1/25 - 1/(365 \times 11.1)$ per day, i.e. not much less than once every 25 days.
37. p. 126, figure 14: A correlation of cycles over less than 2 cycles is of no significance. Many proposed correlations between climatic variations and sunspot cycles have failed as additional data became available (A.B. Pittock, formerly of CSIRO: personal communication based on published work and work in progress). Note that the curves are

¹³The transcript of the *Lateline* interview where Ian Plimer tries to evade this issue, can be found on: <http://www.abc.net.au/lateline/content/2008/s2554129.htm>

labelled ‘sunspot numbers’ and ‘Grain price’ while the vertical axes are labelled ‘number of sunspots’ (meaningless unless the time interval specified) and ‘W/m²’ — a novel unit for grain prices. However, Tim Lambert’s comparison with the original source [figure 7.41 in reference 550] reveals a more complicated degree of falsification:

i: The curve reproduced as *Sunspot numbers* is ‘solar insolation’ (*Sonneneinstrahlung* in the reference 550) and is quantified on the right-hand axis which has the same numerical values as in *Heaven + Earth* in W/m².

ii: In the original, the left hand axis is prices, *Getreidepreise (Mariengroshchen pro 100 kg)*, with the range 100 to 200, i.e. the numbers that Plimer relabels as *Number of sunspots*.

38. p. 131, figure 15: This has multiple problems:
 - i:** unidentified source and data;
 - ii:** selective data use;
 - iii:** Incorrect description in caption [item 39];
 - iv:** highly smoothed CO₂ record added for comparisons;
 - v:** erroneous statement about correlations.
39. p. 131, figure 15 (caption): *Plot of the last 140 years ...* no it isn’t. The plots, starting at 1860 end a little after 1980 (although the time axis extends beyond 2000). Truncating the plots in this way serves to reduce the correlation between temperature and CO₂ and enhance the correlation between temperature and sunspot cycle length.
40. p. 132: *Greenhouse gases act only as amplifiers*. In using the word **only**, Plimer fails to explain how greenhouse gases can have a (amplifying) warming effect when the gas increase is due to other climate change (as in the mainstream interpretation of glacial-interglacial cycles) and yet not have a warming effect when the gas increases are due to human inputs.
41. p. 133: States: *Ice cores from Greenland show the temperature was warmer at 1000 AD*. while the cited reference (footnote 595) indicates that the data are not from the ice core (i.e. the ice extracted from the drill-hole), but are from measurements of temperatures in the hole — [contributed suggestion].
42. p. 148: *Earth has less carbon and water than other planets, asteroids and comets* A very strange statement, particularly for Mercury, Mars and the asteroids — [DK].
43. p. 155: *it took 100,000 years or so for CO₂ to reach equilibrium* — after the Paleocene-Eocene Thermal maximum. This contradicts Plimer’s claims that CO₂ perturbations are rapidly removed from the atmosphere. — [DK].
44. p. 195: *On the global scale satellite measurements of vegetation between 1982 and 1999 showed that plant growth increased by 6% in response to slightly increased rainfall and slightly increased temperature, but the major change was due to slightly increased CO₂*. There is no reference directly associated with this passage but the preceding passage cites the paper *Climate-driven increases in global terrestrial net primary production from 1982 to 1999* [footnote 936] by Nemani et al. (2003). This paper did not provide any specific satellite-derived estimate of the effect of CO₂.

45. p. 198: In fact the sea-ice has expanded and high winds during an Arctic storm killed four polar bears .. Indeed saying sea-ice has expanded may well be true if one writes during the northern winter. The end-date of the record shown as the lower curve in Figure 29, suggests such ‘cherry-picking’. However, the purported Arctic data are a misrepresentation of the source. The curve is a global anomaly — see item 54.
46. p. 217: Mt Pinatubo ... released 20 millions tonnes of sulphur dioxide and very large quantities of chlorofluorocarbons. ... The reference cited for this [footnote 1075] makes no such claims and is not reporting observations of anything. It is about a modelling study that compares the chemical effects of Pinatubo emissions to the effect of chlorofluorocarbons — [also in TL list].
47. p. 219: An almost entirely eruption-free period from 1912 to 1963 coincided with an average global warming of 0.5°C. It is quite possible that the atmosphere warmed due to the lack of a normal quota of volcanic aerosols. Precisely. This statement completely undermines Plimer’s arguments that CO₂ can’t be causing later warming because there was too little CO₂ increase at the time of early 20th century warming.
48. p. 229: In about 9000 years time, perihelion will occur in the Northern hemisphere and aphelion will occurs in the Southern hemisphere, the reverse of today. This is absurd. Perihelion and aphelion are points on the Earth’s orbit and do not occur **in** a specific hemisphere.
49. p. 230: claims that climate models don’t do seasonal variation of insolation, i.e. neglect the ellipticity of the Earth’s orbit. The mean figure of 1367 watts per square metre is used in climate models, thereby omitting the effects of orbit on the change in solar input. This is untrue (personal communication from CSIRO climate modellers). An older, but verifiable and more accessible reference is CSIRO Division of Atmospheric Research Technical Paper no. 26, available on-line from the CSIRO Marine and Atmospheric Research website. Numerous studies have been done with climate models using different values of ellipticity (and different orientations of the Earth’s axis) in order to study other stages of the Milancović cycle. Such studies would be impossible if the shape of the earth’s orbit is ignored.
50. p. 237: There is neither a significant loss nor a gain to polar ice, alpine valley glaciers, and sea ice. One of many unsupported claims in introductory sections, which the subsequent detailed discussion justifies on the basis of flawed assertions. See item 53 regarding cited reference on alpine glaciers. — [DK].
51. p. 246: Some scientific papers suggesting melt waters reaching the base of an ice sheet speed the movement of ices seaward flow. Yet these papers do not even mention creep as the tried and proven alternative explanation of ice movement.^{1222,1223,1224} The Concise Oxford Dictionary of Earth Sciences (1991) defines **glacier creep** as *The deformation of glacier ice in response to stress by a process involving slippage between and within ice crystals.* Reference 1223 notes that *Glacial motions results from a combination of internal deformation of ice under its own weight, sliding at the ice-bed interface and deformation*

- of the underlying sediments. Reference 1224 begins *The Greenland Ice Sheet flows outward from its interior through a combination of internal deformation and basal sliding, . . .* By referring to *internal deformation* these two papers are acknowledging ‘creep’ in more technical terms.
52. p. 277: The initial analysis of the Vostok ice core used samples spaced at intervals of hundreds of years. The initial conclusions were that high CO₂ in the atmosphere led to high temperatures. This is untrue. The initial conclusions over 20 years ago were that the cycles were initiated by orbital changes with changes in CO₂ having a consequent amplifying role. In the relevant paper, the abstract (quoted in full in the discussion below on the Vostok core, see page 48) says *CO₂ changes have had an important climatic role . . . in amplifying the relatively weak orbital forcing.*
53. p. 281: The good news is that alpine valley glaciers are not retreating. Measurements of retreats and advances from glaciers in the period 1946–1995 for 246 glaciers show that there is no sign of any recent global trend towards increased glacier melting.¹⁴⁴¹ The second sentence does not follow from the first: reference 1441 does find that glaciers are retreating, but fails to find evidence of an increased rate of retreat — [TL].
54. p. 287, figure 29: A graph that claims to be area of global sea ice with total area of Antarctic sea ice (upper curve) and Arctic sea ice variations (lower graph) shows negative values for the arctic. In reality, the curve seems to be taken from the site: <http://arctic.atmos.uiuc.edu/cryosphere/IMAGES/global.daily.ice.area.withtrend.jpg>
This identifies the lower curve as *daily global sea ice anomaly* and not Arctic sea ice variations (lower graph).
55. p. 293: *If humans burned all the fossil fuels on Earth, the atmospheric CO₂ content would not even double* — contradicts page 325: *The total amount of carbon in known fossil fuel could only produce 11 times the amount of CO₂ in the atmosphere.* This issue comes down to time-scales, see item 60 — [DK].
56. p. 297 (also on p. 294): El Niño events are not factored into models of future climate. This is untrue. In the WG1 AR4 report, figure 8.13 shows the performance of a range of the climate models in simulating the statistical characteristics of El Niño. Since the El Niño is recognised as part of the chaotic behaviour of the climate system (in spite of Plimer’s claim, item 111, that the IPCC denies this) the sequence of individual El Niño events is unpredictable and the relevant test is of the intensity and frequency distribution — [DK].
57. p. 303: In the three years before the flooding associated with hurricane Katrina devastated New Orleans in August 2005, the city and surrounding area had undergone rapid subsidence of about one metre. There is no reference associated with this claim. However, when the claim is repeated on page 409 a reference is cited, but the subsidence reported in that reference represents an average of 16.8 ± 7.5 mm over the three years — see item 84.
58. p. 312: Al Gore’s Oscar winning movie predicted that sea level would increase by 6 metres in the near future Gore does not put a date on when a 20 foot rise would happen

(nor specify what circumstances). In my view this is one of the serious omissions in Gore's book. A similar view of this omission was taken by the judge in the UK court case over Gore's film and book.¹⁴ Indeed Justice Burton put this first in his list headed *The 'Errors'* [His quotation marks].

59. p. 324, caption of figure 34: These bottom waters are undersaturated in CO₂ hence can dissolve the monstrous amounts of CO₂ emitted by submarine volcanoes. This fails to account for what happens when this water is upwelled to the surface, becoming oversaturated due to the lower pressure.
60. p. 325:¹⁵ The sentence An upper limit on how much CO₂ concentration in the atmosphere will rise if all the available fossil fuel is burned can be calculated. Is followed immediately by In order to permanently double the current level of CO₂ in the atmosphere and keep the oceans and atmosphere balanced, the atmosphere needs to be supplied with 51 times the present amount of atmospheric CO₂. The shift in the argument is the inclusion of the word **permanently**, making the comparison misleading. Indeed without specifying the time-scales, the comparison is meaningless. On the time-scales of tens of millions of years, the geological evidence suggests that the factor of 51 is too small. On timescales of millennia, geological analysis suggests that the factor is in the range 5 to 10. On the century timescale, the factor is closer to 2. A good conceptual analysis of these issues is given by Eric Sundquist of the US Geological Survey in his chapter *Geological perspectives on carbon dioxide and the carbon cycle* [Plimer's footnote 2117].
61. p. 325: If humans burned all the available fossil fuels over the next 300 years there would be 15 turnovers of CO₂ between oceans and atmosphere and all the additional CO₂ would be consumed by ocean life and precipitated as calcium carbonate in sea-floor sediments.¹⁶⁸² Reference 1682 is a one-page comment from 1990, discussing uncertainties in climate sensitivity, projected emission rates and satellite-derived temperature data. It mentions neither CO₂ turnover, nor sediments.
62. p. 329: The repeated use of adsorbed rather than absorbed is discussed in item 74.
63. p. 332: Claims: If any more CO₂ were added to the oceans then calcium carbonate would precipitate.¹⁷³⁸ Reference 1738 is about carbon budgets and its analysis of sediments is about the possibilities of sediments dissolving, not new sediment forming. The relevant chemical reaction is:



so that increasing CO₂ (and thus H₂CO₃) tends to shift the balance to increasing 2HCO₃⁻ by removing CO₃²⁻ and so making carbonate sediments more soluble. (The conclusion in reference 1738 was that this was not an immediate threat over significant areas of the ocean floor.)

¹⁴The judgement is at <http://www.bailii.org/ew/cases/EWHC/Admin/2007/2288.html>. In versions prior to 2.1, before I rechecked the wording, the comment here about the judgement was noted as my recollection. Version 2.1 gave the URL incorrectly — thanks to Philip Machanik for pointing this out.

¹⁵In versions prior to 1.6, this issue was incorrectly noted as being on page 235.

64. p. 338: There is no such thing as a “tipping point” (or even a “precautionary principle”) in science. The precautionary principle is proposed for the conduct of human affairs. No-one seriously proposes it as a scientific principle. (If it was a scientific principle there would be no need to argue for its use — it would just happen). There is such a thing as a “tipping point” in science, but the more technical name is “catastrophe”. An accessible account is given in the book *Catastrophe Theory* by V. I. Arnold (Springer-Verlag, 1984, 1986). Since not all things that are catastrophes in the mathematical sense are catastrophic in the human sense, the use of a less ambiguous term such as “tipping point” seems desirable for public communication.
65. p. 346–347, figures 38, 39, 40: Annual averages show sea surface temperature rises whereas monthly averages do not. and in the caption of figure 40: The three diagrams show that the data can easily be manipulated to create a desired outcome. Actually **no**. In particular the linear trend will be almost the same in each case, with small differences coming from a few months at the end. Fitting a trend to monthly, 5-monthly or 12-monthly averages involves (apart from the ends and some rounding of times) the same sums over the same months, whether or not one deals with averages. Using 5-month averages just means that each month gets added in 5 times (and divided by 5). From the basic laws of arithmetic, the sum of a set of numbers does not depend on the order in which they are added. So why do the graphs seem to have different trends: because they are plotted on different scales. Each actually shows about 0.7°C increase over the 40-odd years. This same scam was used by Michael Crichton in *State of Fear* comparing US and global data — see section 3.2 of *Twisted*.
66. p. 350: The El Niño most commonly occurs in late December, lasts for a month or so ... compared to p. 352 El Niño lasts for 1 to 2 years.
67. P 351: In India in the 1920s ... Walker used weather stations at Darwin (Australia) and Tahiti, which had 100 years of records and showed a see-saw correlation (hence the Southern Oscillation). Wrong. There were not 100 years of records from Darwin because Darwin was not settled until 1869 (initially called Palmerston). More specifically, Walker used a large number of records, and even by the early 1930s, few of these had more than 50 years of data — [DK].
68. p. 365: Clouds are not factored into climate models. Untrue. See for example sections 12 and 13 of CSIRO Division of Atmospheric Research Technical Paper no. 26, available online from the CSIRO Marine and Atmospheric Research website. Also many textbooks.
69. p. 366: assertion of the 0.5°C climate sensitivity with no citation and contradicting other values given by Plimer [items 104, 124] — [TL].
70. p. 366: The Earth has an average surface temperature of about 15°C, followed a few sentences later by If the atmosphere had no CO₂ far more heat would be lost and the average surface temperature would be about –3°C. The implication of attributing 18°C of warming to CO₂ while saying [caption of Figure 44] About 98% of the greenhouse effect in the atmosphere is due to water vapour is to imply that in the absence of CO₂ and H₂O,

the temperature would be 900°C lower, i.e. well below the physical limit of absolute zero.

71. p. 367: However, Arrhenius was not aware of the carbon cycle . . . Arrhenius' 1896 paper explicitly includes geological aspects of the ocean carbon cycle, drawing on the work of geologist Arvid Högbom, going to the extent of providing a summary translation of some of Högbom's work at the end of his own paper.
72. p. 370, figure 44: As noted in item 70, the exaggerated proportion of warming attributed to water vapour in the graphic and caption, implies that water vapour is warming the planet from a temperature below absolute zero — [also in TL list].
73. p. 371: assertion of the 0.5°C climate sensitivity with no citation and contradicting other values given (or implied) by Plimer [items 104, 124] — [TL].
74. p. 374: Once there is 400 ppm of CO₂ in the atmosphere, the doubling or tripling of CO₂ content has little effect on atmospheric temperature because CO₂ has adsorbed all the infra-red it can adsorb. The term '**adsorb**' is defined (Macquarie Dictionary) as "to gather a gas, liquid or dissolved substance) on the surface of a condensed layer . . .", c.f. '**absorb**' for which the same dictionary's definitions include: **5.** to take or receive in by chemical or molecular action while Chambers Twentieth Century dictionary's definition of 'absorb' includes: "to suck in, to swallow up, ... to take up and transform (energy) instead or transmitting or reflecting". An consistent failure [see also items 62, 94] to distinguish between 'adsorb' and 'absorb' does not inspire confidence.
75. p. 375, figure 50:¹⁶ As with many of the graphics, this is poorly described with no attribution of the numbers (see item 3). However above 100 ppm the values seem to be inversely proportional to concentration as expected for incremental change when temperature has a logarithmic dependence on concentration (which Plimer acknowledges on p. 338). Thus a better label for the vertical axis would be 'incremental warming'. This means that the claim in the caption once the atmosphere is at its present 385 ppm, a doubling or quadrupling will have very little effect on the atmospheric temperature is untrue. (Note also similar statement on previous page — item 74). Each doubling will have the same effect on temperature until concentrations get so high that the logarithmic relation breaks down. The trend in Figure 50 shows no sign of this happening around 400 ppm. The bars would imply that the increments correspond to each additional 20 ppm of CO₂. This would imply a climate sensitivity of 0.35°C. While the origin of the numbers is not given, the discussion on page 42 below notes that they can be explained by using 0.5°C for the climate sensitivity (the lowest of Plimer's other values) and then having a factor of 1.44 error through neglecting to consider the change of base of logarithms.
76. p. 381:¹⁷ In fact, satellites and radiosondes show that there is no global warming.¹⁹¹⁰. Reference 1910 is a 2007 overview by Charles F. Keller which updates his 2003 report (CFK03). The words in reference 1910 are: *The big news since CFK03 is the first of*

¹⁶Prior to version 1.4, this was incorrectly noted as fig 5.

¹⁷Prior to version 2.1, the page number was given incorrectly as 379.

these, the collapse of the climate critics' last real bastion, namely that satellites and radiosondes show no significant warming in the past quarter century. Reference 1910 describes the issues with the satellite and sonde data that gave the incorrect appearance of no trend.

<http://www.abc.net.au/lateline/content/2009/s2772906.htm> gives the transcript (and link to vodcast) of a debate broadcast by the ABC, where Plimer was accused of fraud on the basis of turning the content of his cited reference to Keller through 180 degrees.¹⁸

77. p. 382: In fact, satellites and radiosondes show that there is no global warming.¹⁹¹⁸ Reference 1918 is the same reference as 1910 and so the comments in item 76 apply equally here — [TL].
78. p. 398: attempts to use only stalagmite ring widths to ascertain climate variation shows that there is no relationship between stalagmite ring width and tree rings in the same area.¹⁹⁹⁰ when in fact reference 1990 makes no mention of tree rings — [email contribution].
79. p. 401: Ice cores also record human activity. . . . The increase in CO₂²⁰⁰¹ and methane²⁰⁰² is also recorded. Reference 2001 refers to measurement of samples from the atmosphere, not from bubbles in an ice core.
80. p. 402: Measurements of CO₂ methane and temperature in ice cores show a saw-tooth pattern²⁰⁰⁵. Reference 2005 [Dahl-Jensen et al., 1998] presents no data on CO₂ or methane. The longest temperature record is 50,000 years – too short to show the 100,000 year saw-tooth pattern.
81. p. 402: There was no “tipping point” and the temperature-CO₂ plots clearly showed that the rise in temperature was stopped by something other than CO₂.²⁰⁰⁷ — comparison with reference 2007, a paper by Wunsch, reveals that the paper does not discuss any aspect of CO₂.
82. p. 402: New high resolution studies over the last 450,000 years of Vostok core show that at all times of cold to warm transitions, temperature rise is followed by a rise in CO₂ some 800 years later.²⁰⁰⁹ Reference 2009 [Caillon et al., 2003] only analyses a period between 230,000 and 255,000 years ago (spanning ‘Termination III’), thus does not analyse the last 450,000 years and so does not justify claims about all times of cold to warm transitions.
83. p. 407: Actual measurements for 2007 show that it was one of the coldest years this century and the coldest since 1995. Compare to figure 1 on page 11 of *Heaven + Earth*. The claim ‘coldest since 1995’ is clearly untrue. Calling it ‘one of the coldest this century’ (i.e. not even *the coldest*) is fairly insignificant with only 8 or 9 years (depending on whether you regard the century as beginning on 1/1/2000 or 1/1/2001).

¹⁸The transcript notes the page as 383, rather than 381, 382 (as reference 1918), or my original incorrect 379. This may indicate a different edition of the book.

84. p. 409: New Orleans sunk rapidly by about 1 metre in the three years before Katrina struck. This time (unlike page 303, item 57) a reference is cited: by Dixon and others *Nature*, **441**, 587–588 (2006) from radar satellite altimetry. They report a three-year average of -5.6 ± 2.5 mm/year, with a maximum of -29 mm/year (negative values indicating subsidence). They note that if the motion is interpreted as purely vertical, the mean and maximum subsidence become 6.4 mm/year and 33 mm/year.
85. p. 411: Carbon dioxide is a colourless odourless non-poisonous gas. If taken literally, this is dangerously misleading. Some of the relevant toxicity data from *Chemwatch #1003 (1999)*¹⁹ are:
 7% to 10%: unconsciousness within minutes;
 5% fatal dose for inhalation;
 2% adverse pulmonary effects;
 and various adverse effects from continuous exposure at lower concentrations around 1%.
86. p. 412: Plimer notes that limestone contains 65,000,000 billion tonnes of carbon (i.e. 65,000,000 GtC) forgetting that his own figure of 200 GtC per year in CO₂ from volcanoes would imply that limestone sediments are, on average, being turned over every 325,000 years. (Since the carbon is not accumulating in the oceans at such a rate, not accumulating in the atmosphere at that rate, and plant carbon is not growing at 10% per annum, re-deposition in sediments remains the only possibility.)
- The 200 GtC/year figure is from A sceptical look at greenhouse, by Ian Plimer in *The Skeptic*²⁰, vol. 13, pp 11-17, 1994.
 - In *Heaven + Earth*, Plimer seems to evade the issue of giving an estimate of volcanic CO₂ emissions, but on p. 413 says Volcanoes produce more CO₂ than the world's cars and industries combined — [DK, TL]. — and
 - Volcanoes add far more CO₂ to the oceans and atmosphere than humans (p. 328) — [DK]. — and
 - p. 472: massive volcanic eruptions (e.g. Pinatubo) emit the equivalent of a years' human CO₂ emissions in a few days. No citation is given. Actual data shows that the CO₂ growth rate declined after the Pinatubo eruption — [TL].
 - <http://www.abc.net.au/lateline/content/2009/s2772906.htm> gives the (transcript and link to vodcast) of the debate broadcast by the ABC (noted in item 76) which includes Plimer being questioned on his claims about undersea volcanoes contradicting detailed studies by the US Geological Survey.
87. p. 413: Animals produce 25 times as much CO₂ as cars and industry. Irrelevant and untrue. A common irrelevant argument used by doubt-spreaders. Animal CO₂ production doesn't affect climate because it is putting back carbon taken out of the atmosphere by plants. However 25 by 7 GtC/year is exaggerated. Even if no plant material decayed directly to CO₂, or decomposed by bacteria or burnt by wild-fire, Plimer's figures would

¹⁹The summary is for illustrative purposes. Health and Safety issues should be addressed by reference to the full chemical data sheets.

²⁰Publication of the Australian Sceptics Society.

have animals chomping through plant material at about 2 or 3 times the rate (the Global Net Primary Production of 50 to 100 GtC per year) at which plants remove the carbon from the atmosphere — thus eating all the world's biomass in a few decades.

88. p. 415: The C^{14} proportion of total carbon in the atmosphere is decreasing, suggesting that there is an increased biological contribution of CO_2 to the atmosphere. The proportion of atmospheric ^{14}C is decreasing because atmospheric CO_2 , with ^{14}C from nuclear testing is being taken up into the oceans and replaced by (old) CO_2 upwelled from the deep oceans and so uninfluenced by the nuclear testing. Note that this interpretation of the ^{14}C data lies behind some of the estimates of air-sea gas exchange that Plimer mis-interprets as estimates of 'CO₂ lifetime'.
89. p. 417: ..the observatory was evacuated for a few months and there was a gap in the data record which represented a period of no measurements. There are now no gaps in the Mauna Loa data set. To refer to **the** Mauna Loa (CO_2) data set, is misleading since there are three main records: The Scripps in-situ IRGA measurements established by C. D. Keeling; the NOAA in-situ IRGA measurements and the NOAA flask program which is part of a global network for which flasks of air are shipped back to the central NOAA laboratory in Boulder, Colorado. The main archive/access location for CO_2 data is the Carbon Dioxide Information and Analysis Center (CDIAC), in Oak Ridge, Tennessee. Other programs such as CSIRO also produce records from Mauna Loa as part of the on-going validation activity. The graphic at: http://cdiac.ornl.gov/trends/co2/graphics/Mauna_Loa_CO2.jpg shows extensive gaps in the early part of the Scripps record.
90. p. 417: The annual mean CO_2 atmospheric content reported at Mauna Loa for 1959 was 315.93 ppmv. This was 15 ppmv lower than the 1959 measurements for measuring stations in northwestern Europe. Measured CO_2 at Mauna Loa increased steadily to 351.45 ppmv in early in 1989. The 1989 value is the same as the European measurements 35 years earlier by the Pettenkofer method.... Plimer's references for the European program are two papers by Bischof in 1960 and 1962 [footnotes 2094 and 2095 respectively]. The 1960 paper quotes annual means of — 1955: 326 ppm; 1956: 321 ppm; 1957: 323 ppm; 1958: 315 ppm; 1959: 331 ppm. For such a short passage, Plimer is showing a remarkably high number of errors:
- i:** 1959 to 1989 is 30 years, not 35 years;
 - ii:** 15 ppm above 315.9 ppm is 330.9 ppm, close to the annual mean reported for Mauna Loa for 1975, not 1989.
 - iii:** during 1959 the Swedish group switched to the more precise Infra-Red Gas Analyser (IRGA) with precision determined as ± 1 ppm, while they found the precision of the chemical method to be ± 3 ppm — thus the 1959 data were not all from the chemical method;
 - iv:** the whole comparison is biased by comparing a high altitude site with surface data. The relevant comparison is with the data reported by Bischof (1962), sampling air during aircraft flights. The values for air from above about 1km are from 308 ppm to 320 ppm with a mean of 314 ppm, very close to the 315 ppm at Mauna Loa.

91. p. 417–8: Furthermore, the measurement at Mauna Loa is by infra-red analysis and some of the ice core measurements of CO₂ in trapped air were by gas chromatography. Exactly. There are two techniques, IRGA and GC, with good precision and which agree with each other,²¹ and a third (chemical) technique with inherently lower precision which requires great experimental skill to achieve accuracy.
92. p. 418: land-derived air blowing across the sea loses about 10 ppm of its CO₂ as the CO₂ dissolves in the oceans. High-CO₂ air from over land often has the concentration drop due to vertical mixing. A more realistic estimate of how much drop can be caused by the oceans (over large areas) is obtained by comparing measurements of CO₂ at Cape Grim Tasmania which, when measured in air coming off the ocean averaged about 1 ppm lower than air measured by CSIRO on flights over Bass Strait.
93. p. 419: The lowest figure measured since 1812, the 270 ppm figure, is taken as the pre-industrialisation yardstick. The IPCC want it both ways. They are prepared to use the lowest determination by the Pettenkofer method as a yardstick yet do not acknowledge Pettenkofer method measurements showing CO₂ concentrations far higher than now many times since 1812. The IPCC does not use 270 ppm as the pre-industrial CO₂ concentration. The value used is 280 ppm. In the various WG1 reports, see SPM table 1 in 1990, technical summary (TS) table 1 in SAR, TS table 1 in TAR, and page 2 in SPM of AR4. This number is based in measurements of air in ice bubbles (mainly using IR techniques) and excluding anomalously low values from the time of the Little Ice Age. For ice cores, the volume of air available is too small to use the less precise chemical (Pettenkofer) method.
94. p. 421: CO₂ molecules will be removed fast from the atmosphere to be adsorbed in another reservoir — inability to distinguish ‘adsorbed’ from ‘absorbed’ yet again — see item 74.
95. p. 421: For CO₂, The IPCC asserts that the lifetime is 50–200 years. The IPCC has been criticised because the lifetime is not defined. In reality the IPCC (1990) says in the SPM The way in which CO₂ is absorbed by the oceans and biosphere is not simple and a single number cannot be given and in the footnote to table 1: The “lifetime” of CO₂ is given in the table is a rough indication of the time it would take CO₂ concentrations to adjust to changes in emissions. (see section 1.2.1 for further details), with section 1.2.1 stating The turnover time of CO₂ in the atmosphere, measured as the ratio of content to the fluxes through it is about 4 years. ... This short time scale must not be confused with the time it takes for the atmospheric CO₂ level to adjust to a new equilibrium of sources or sinks change.
96. p. 422: Calculations of the lifetime of atmospheric CO₂ based on natural C¹⁴ give lifetime values of 3 to 25 years (18 separate studies), dilution of the atmosphere from fossil fuel burning a lifetime of 2 to 7 years (two separate studies), atomic bomb C¹⁴ lifetime value of 2 to more than 10 years (12 separate studies) ... This is referenced by footnote 2117

²¹An additional technique based on single-line spectroscopy is becoming increasingly important — Eighth International Conference on Carbon Dioxide, and associated WMO experts’ meeting.

at the beginning and footnote 2118 after additional cases not quoted above. This makes it difficult to identify which citation applies to which group of claims. In the case of reference 2117 (Eric Sundquist's article *Geological perspectives on carbon dioxide and the carbon cycle*, noted above in connection with item 60), the misrepresentation is particularly clear. Sundquist describes carbon balance and the decay of perturbations in terms of competition between the flux to and from the atmosphere. In these terms his estimates are of the one-way fluxes, i.e. Plimer is omitting half of Sundquist's calculation, thus turning approximate balance into a claim of rapid net loss of CO₂ from the atmosphere.

97. p. 422: There is considerable difference in the atmospheric CO₂ lifetime between the 37 independent measurements and calculations using six different methods and the IPCC computer model. This discrepancy has not been explained by the IPCC. As noted in item 95, Plimer is misrepresenting estimates of turnover time as being estimates of a characteristic lifetime for CO₂ perturbations. The difference **has** been explained in IPCC reports — see in particular section 2.1.4 of the WG1 Second Assessment Report. (Of course, in criticising the IPCC computer model, Plimer is referring to something that doesn't actually exist).
98. p. 422: If the CO₂ atmospheric lifetime were 5 years, then the amount of the total atmospheric CO₂ derived from fossil fuel burning would be 1.2% not the 21% assumed by the IPCC. This would appear to conflict with Oceans, soils and plants already absorb at least half the human CO₂ emissions on page 472. In fact both statements are roughly true — the conclusion that resolves this apparent conflict is that a 5-year 'atmospheric lifetime' does **not** characterise atmospheric CO₂.
99. p. 422: In order to make the measurements of the atmospheric CO₂ lifetime agree with the IPCC assumption, it would be necessary to mix all the CO₂ derived from the world's fossil burning with a different CO₂ reservoir that was five times larger than the atmosphere.²¹²³ — Reference 2123 (which is also reference 1738) does not support such a claim. It gives an outline of the atmosphere-ocean-biosphere carbon dynamics which is quantitatively similar to current mainstream understanding, even though this 1979 analysis pre-dates both the IPCC (and its alleged 'assumptions') and the availability of CO₂ concentrations from ice cores. Indeed, the ability to understand the carbon cycle using radiocarbon data, without reference to CO₂ concentrations from ice-cores, seriously undermines the significance of attacks on the ice-core data. As a measure of the accuracy, endnote 13 of reference 2123 estimates that human activity had increased CO₂ by 35 ppm. Ice-core data would indicate that the increase to that time was nearer to 45 ppm. This is about a 30% error, not the factor of 5 or more claimed by Plimer.
100. p. 425: The IPCC 2007 report stated that the CO₂ radiative forcing had increased by 20% in the last 10 years. Radiative forcing puts a number on increases in radiative energy in the atmosphere and hence the temperature. In 1995, there was 360 ppmv of CO₂ whereas in 2005 it was 378 ppmv, some 5% higher. However each additional molecule of CO₂ in the atmosphere causes smaller radiative forcing than its predecessor and the real increase in radiative forcing was 1%. The IPCC have exaggerated the effect of CO₂ 20-fold. As Plimer notes, radiative forcing is about **increases**. The IPCC (see AR4

WG1 glossary) defines radiative forcing as the change relative to the year 1750. This is also noted in footnote 2 of the SPM when the concept of radiative forcing is introduced. Using the logarithmic formula to account for the diminishing effect of additional CO₂, $=\log(378/280)/\log(360/280)$ in a spreadsheet, gives a 1.194 multiplier from 1995 to 2005, i.e. a 19.4% increase. This does not depend on the value of the climate sensitivity. The same result is obtained with any of Plimer's 3 values (0.35°C from figure 50, the 0.5°C that he asserts without citation, or the 1.5°C to 1.6°C from the long-term historical data that he cites, e.g. item 104). (A value of 20% is obtained if the 1750 concentration is taken as 282 ppm.) — [also in TL list].

101. p. 425: IPCC does not acknowledge that CO₂ derived from human activity produces 0.1% of global warming.²² Using Plimer's preferred (but unrealistically low) climate sensitivity of 0.5°C, typing $=1.44*0.5*LN(385/280)*1000$ into a spreadsheet gives a warming of 229°C, implying that without human and natural greenhouse gases, the temperature of the earth would be like that of the outer planets. Using the empirical (but still unrealistically low) estimate of 1.5°C quoted by Plimer on page 426 would imply that without human and natural greenhouse gases, the temperature of the Earth would be below the physical limit of absolute zero.
102. p. 425: During times of ice ages such as 140,000 years ago, the CO₂ content of the atmosphere was higher than the pre-industrial revolution figure of 270 ppmv.²¹³⁴ This is 'cherry-picking' from two different estimates of the Vostok dating. According to reference 2134 (published in 1990), 140,000 years ago, the CO₂ concentration was around 270 ppm, but the world was no longer in an ice age. According to more recent dating²³, 140,000 years ago CO₂ was below 200 ppm and significant warming did not begin until about 500 years later — [DK].
103. p. 425: The current CO₂ content of the atmosphere is the lowest it has been for thousands of millions of years, .. which is clearly inconsistent with noting a current concentration around 385 ppm and many occasions noted by Plimer (e.g. on page 278) with CO₂ around 180 ppm within the last million years.
104. p. 426: The variation in CO₂ shows that a climate sensitivity of greater than 1.5°C has probably been a robust feature of the Earth's climate system for over 420 million years. This is a repeat of the statement on p. 87 (citing the same reference, [Royer et al., 2007] as reference 2140) and contradicts his frequent undocumented assertion [items 69, 73, 120] that the climate sensitivity is 0.5°C.
105. p. 430: If we drive a diesel car with an efficiency of 5.5 litres per 100 km then the daily greenhouse effect of one cow is equivalent to driving 10,000 km in this car. Well actually no — one cow (150 to 250 litres of methane gas per day) is the equivalent of 14 to 23 km driving — out by a factor of 400 or more. — [CA].

²²The summary in versions up to 1.5 incorrectly gave Plimer's number as 1%.

²³Using the dataset described on page 48.

106. p. 432: When discussing ozone depletion and the Montreal Protocol, Plimer asserts: One of the critical molecules, dichlorine peroxide, appears to break down far slower than was thought[sic].^{2158,2159,2160}

Reference 2160²⁴ is the paper announcing the discovery of the ‘Ozone hole’ and so is not directly relevant to the global-scale ozone depletion which the Montreal Protocol aims to mitigate. In particular, reference 2160 makes no mention of dichlorine peroxide.²⁵

107. p. 433: Water vapour tends to follow temperature change rather than to cause it. . . . Water vapour is an amplifier rather than a trigger. Precisely — this is the mainstream view and contradicts most of Plimer’s arguments about water vapour, including that noted in the following item.

108. p. 433: The vent opens to release heat when sea surface temperature rises, resulting in a decrease in high clouds above the western tropical Pacific Ocean when sea surface temperatures are higher.²¹⁶² This work validates earlier work²¹⁶³ and was confirmed in later studies^{2164,2165,2166}. Lindzen’s ‘iris’ theory (from reference 2162: *Does the Earth have an adaptive infra-red iris*) has been tested and found wanting. In particular, in reference 2164 : *Tropical cirrus and water vapor: an effective Earth infrared iris feedback?* their answer to the question raised by the title is “NO”. Specifically, their abstract states: *We argue that the water vapor feedback is overestimated in Lindzen et al. (2001) by at least 60%, and that the high cloud feedback is small. . . . Using more realistic parameters in the model of Lindzen et al. (2001), we obtain a feedback factor in the range of -0.15 to -0.51, compared to their larger negative feedback factor of -0.45 to -1.03. It is noted that our feedback factor could still be overestimated . . .* and conclude the paper with *It should be noted that for ANY rate of changes of cloudy- and clearmoist areas with changing SST, the feedback due to such a change will be significantly smaller than that suggested by LCH.*, LCH referring to Lindzen et al. (2001).

109. p. 437: If governments had read the fine print of the crucial chapter 5 of the IPCC AR4 (Humans responsible for climate change) they would have realised that it was based on the opinions of just five independent scientists. This implies that the chapter is called Humans responsible for climate change. This is untrue. In the AR4 WG1 report chapter 5 is called *Observations: Oceanic Climate Change and Sea Level*. The words Humans responsible for climate change are not the title of any section or subsection of chapter 5 (nor the title of any other chapter in the AR4 WG1 report). The executive summary of chapter 5 does not include any discussion of attribution of responsibility for the changes that are described. The total number of authors is 13, coming from 9 different countries with Corrinne Le Quéré spending part of her time in a 10th country. Similarly, in the AR4 reports from working groups 2 and 3, neither chapter 5 nor any other chapter has the title Humans responsible for climate change — [also in TL list].

²⁴Versions of this document through to 2.1 incorrectly referred to reference 2060 rather than 2160 throughout this item.

²⁵Cl₂O₂ or ClOOCl, also termed chlorine peroxide.

110. p. 438: The IPCC has essentially ignored the role of natural climate variability. In reality the various IPCC WG1 reports have chapters entitled: 7: *Observed Climate Variations and Change* (1990); 3: *Observed Climate Variability and Change* (1996); 2: *Observed Climate Variability and Change* (2001); 6: *Paleoclimate* (2007).
111. p. 439: referring to the 2001 report the report of the IPCC claimed that, based on computer model simulations, climate has only limited variability and hence was not dynamic, non-linear and chaotic. Actual words [page 95, WG1 report, TAR] are: *Since the pioneering work of Lorenz in the 1960s, it is well known that complex non-linear systems have limited predictability, even though the mathematical equations defining the time evolution of the system are perfectly deterministic. The climate system is, as we have seen such a system*
112. p. 439: In discussing the role of chaos: Five simulations were undertaken for the period 1860–2000 using the same general circulations models that are used by the IPCC. Each simulation had slightly different initial conditions, but otherwise was the same. Very small differences in the initial conditions of climate resulted in large differences in large variations in later climate.²¹⁷⁸ This has minor misrepresentations: there was only one model, and the initial conditions were different weather ‘snapshots’ from a control run with only internal climate variability²⁶. The serious misrepresentation is that of large differences in later climate. There were, as expected, large differences in subsequent weather variations, but the later climates (i.e. multi-decadal averages and trends) were quite similar.
113. p. 443 [footnote 2181]: repeats Monckton’s claims about *An Inconvenient Truth* without mentioning that most were rejected by the court.²⁷ More precisely, what the judgment²⁸ says of the plaintiff’s counsel is that *Mr. Downes produced a long schedule of such alleged errors and waxed lyrical in that regard.* and later: *In the event I was persuaded that only some of them were sufficiently persuasive to be relevant for the purposes of his argument, and it was those matters — 9 in all — upon which I invented Mr Chamberlain²⁹ to concentrate.* There-after, the judgement uses quotation marks around the word “errors”.
114. p. 450: There was a statistical study to show that the 20th century was unusually warm²¹⁸⁵ ... and .. another paper showing that appropriate tests that link climate proxy records to the observational data were not utilised and, as a result, the unusual warmth of the 20th century disappeared²¹⁸⁶. What reference 2186 actually says is that *the significance of the 20th-century warming anomaly disappears.* — the change is not in the 20th century warming but rather in the level of statistical significance (95% rather than over 99% as suggested in reference 2185).

²⁶and as always, the false claim that the IPCC ‘uses’ the models

²⁷The first sentence of this item was included as a contribution from Tim Lambert and temporarily dropped until I had time to expand on the word ‘rejected’.

²⁸Available from <http://www.bailii.org/ew/cases/EWHC/Admin/2007/2288.html>. As noted previously, version 2.1 had the URL incorrectly.

²⁹For the defence.

115. p. 472: Oceans, soils and plants already absorb at least half the human CO₂ emissions
Uptake of just over half of human emissions by the oceans, soils and plants is the view of mainstream science. The reason to note this statement by Plimer is that it is inconsistent with Plimer's claims about CO₂ lifetimes and large emissions from volcanoes. In particular, with the 4-year lifetime that Plimer claims, the only way half of human emissions can be in the atmosphere is if most emissions have occurred within the last few years.
116. p. 477–478: The discussion of Stern's work quotes a paper by Klyashtorin and Lubushin (footnote 2221) when referring to data from many sources. The Klyashtorin and Lubushin paper is often cited (and mis-quoted) by pseudo-sceptics/doubt-spreaders. It finds no correlation between detrended series for temperature and fuel use. It is not comparing temperature to fossil carbon emissions. It is comparing temperature to what the carbon emissions would have been if all energy use (including nuclear) had come from oil. As described in *Twisted*, a number of other aspects of the fit act to reduce the type of correlation that would be obtained. However, in *Heaven + Earth* the citation is essentially irrelevant.
117. p. 479: Footnote 2235 is a repeat citation of footnote 2221, the Klyashtorin and Lubushin paper [see item 116]. Since its sole climate analysis is comparing temperature to energy use (and finding *no true linear correlation* in the detrended series), this citation provides no meaningful support for the statement that the next major climate change will be cooling.
118. p. 484: The 2007 IPCC SPM showed cooling for 100 of the last 160 years, during which time greenhouse gases were increasing. Up to version 1.4, my response was: *Possibly true but irrelevant — what matters is if net year-to-year increase is significantly positive*. However, on the basis of random walk statistics, my vague scepticism in saying *possibly*, should be changed to *highly unlikely and irrelevant*. A more complete comment is *highly unlikely, irrelevant and yet another fabrication*. The SPM figure is repeated in chapter 3 (in the FAQ section) of WG1 AR4, where the source of the numbers is identified as the HadCRU3 data set. Looking at the year-to-year changes³⁰ reveals 80 increases and 78 decreases. (The 'variance reduced' HadCRU3 set has 78 decreases and 80 increases) — [also in TL list].
119. p. 485: The Montreal Protocol used the precautionary principle to attempt to ban chloro-fluorocarbons because these gases destroy ozone. However we use chlorine every day to make water fit to drink and yet chlorine also destroys ozone. There is no such thing as the precautionary principle in science. This misrepresentation of the precautionary principle is discussed in item 64. The passage misrepresents the role of chlorine, in that reactive chlorine compounds are removed in the lower atmosphere (mostly ending up as water soluble compounds that dissolve in rainwater) while unreactive compounds such as CFCs are only destroyed in the stratosphere (due to higher UV levels) and where rain-out does not occur. It is the chlorine from CFC breakdown that destroys ozone — Plimer's use of the word 'also' suggests that he doesn't understand this — [also in TL list].
120. p. 488: another undocumented assertion of the 0.5°C climate sensitivity.

³⁰File hadcru3gl.txt, see description on page 41.

121. p. 488: the IPCC models just don't do clouds — false — see item 68.
122. pp. 489–493: Choosing to end with a summary from someone (Viscount Monckton) who is not a scientist is a strange choice. Some of the points [items 123, 126] are particularly questionable. Plimer's text does not indicate whether the references 2281 to 2311 cited in support of the various assertions are in Monckton's original or whether they represent and addition by Plimer.
123. p. 490: present temperature is .. up to 3°C below the Minoan, Roman and Medieval warmings^{2282,2283}. The cited references (2282 is for Vostok ice core data and 2283 is the 1990 IPCC report) do not support this claim of up to 3°C. The Vostok paper does not refer to the MWP and the IPCC report has only a schematic [figure 7.1] with no units on the temperature scale.
124. p. 490: Plimer (quoting Monckton) asserts that the world was only 7°C warmer with 20 times the amount of atmospheric CO₂. This give impression that the effect of CO₂ on climate is small, but ignores the logarithmic dependence. This dependence has been known since Arrhenius, acknowledged by Plimer on p. 338 (with the consequent incremental changes illustrated in figure 50) and often cited by greenhouse pseudo-sceptics such as Bob Carter as a reason for not worrying. If taken at face value, this assertion would imply a climate sensitivity of 1.6 degrees — just over half Hansen's estimate and below the lower end of the IPCC range, but still not insignificant. This can be easily checked by typing $= 7.0 * \log(2.0) / \log(20.0)$ into a spreadsheet.
125. p. 490: The January 2007–January 2008 fall was the steepest since 1880.²²⁹⁸ where footnote 2298 reads *GISS, Hadley, NCDC, RSS, UAH: all 2008*. If *the steepest* is taken as *the largest drop over a 12-month period*, then Plimer's statement is false. In the Hadley record, larger decreases over 12 months occur from Dec. 1891 to Dec. 1892 [0.647°C], Aug. 1945 to Aug. 1946 [0.639°C] and Feb. 1973 to Feb. 1974 [0.681°C] – [thanks to AJG].
126. pp. 491–492: Sea level may rise by 1 foot to 2100, not 20ft as Gore claims. A variant on the incorrect claim made on page 312, see item 58. Gore does not put a date on when a 20 foot rise would happen (nor specify what circumstances). This omission was noted by the judge in the UK court case over Gore's film and book, a case in which Monckton was involved.³¹

Cherry picking

Cherry-picking is the common term of selective use of data to achieve a pre-intended result (or for comparable selective citing of references). The distinction between when a reference is being 'cherry-picked' and when it is being outright misrepresented is of course somewhat arbitrary.

Various forms of cherry picking include:

³¹The judgement is at <http://www.bailii.org/ew/cases/EWHC/Admin/2007/2288.html>. As with item 58, in versions prior to 2.1, before I rechecked the wording, the comment here about the judgement was noted as my recollection. As noted previously, version 2.1 gave the URL incorrectly.

- selecting subseries from a data record when the full record fails to support the claim;
 - using old data, when newer data fail to confirm the claim;
 - selective quoting from references.
127. p. 26, footnote 25: The use of a newspaper as the source of the claim that 2008 was an exceptionally cold year, rather than use any of the data records plotted in figure 4 on the same page.³²
128. Item 24 notes the selective quoting of reference 256, ignoring the words *A warming followed, yielding temperatures that averaged 0.1–0.5 K above present-day in the interval 500–1000 years ago.*
129. An example of cherry-picking terminology is with respect to acidification. Acidity is measured on the pH scale with a pH of 1 meaning highly acidic, a pH of 14 meaning highly alkaline and pure water having a pH of 7. The two possible meanings of ‘acidification’ are (a) a reduction in pH (the usual meaning in discussions of impacts of CO₂), and (b) reducing the pH to below 7 (apparently Plimer’s usual interpretation).
- p. 338: reference 1786, gives change in pH (i.e. they are using meaning (a)) while Plimer asserts that the studies claim that oceans will become acid (i.e. meaning (b)) — thus Plimer is ‘cherry-picking’ the alternative meanings in order to misrepresent the study.
130. p. 402: New high resolution studies over the last 450,000 years of Vostok core show that at all times of cold to warm transitions, temperature rise is followed by a rise in CO₂ some 800 years later.²⁰⁰⁹. Apart from the misrepresentation noted in item 82, reference 2009 is ‘cherry picked’. The abstract states *The sequence of events during Termination III suggests that the CO₂ increase lagged Antarctic deglacial warming by 800 ± 200 years and preceded the Northern Hemisphere deglaciation* Plimer ignores and preceded the Northern Hemisphere deglaciation. — [DK].
131. p. 418: This describes a number of potential problems with the Mauna Loa record, ignoring the fact that at the same time, Keeling established a measurement program at the South Pole where such problems do not occur.
132. p. 425: Item 102 notes Plimer’s use of two different estimates of the dating the Vostok ice core, to support the claim that CO₂ was over 270 ppm in a glacial time.
133. The blurring of the boundary between ‘cherry-picking’ and outright misrepresentation is exemplified by Plimer’s discussion of the temperature data from satellites. The history is that the initial estimates from these data suggested no trend in tropospheric temperatures. Later analysis indicated problems with these estimates and the corrections indicated that tropospheric temperatures were increasing.

³²As an aside, the link given in footnote 25 was no longer accessible on 2009/9/1.

The various aspects of Plimer's misrepresentation can be summarised (in order of increasing seriousness) as:

- using older data when newer analyses have shown these data to be flawed;
- using such data when his own cited references (the Keller paper cited in footnotes 1910, 1918) point out the errors;
- misrepresenting the Keller paper that he cited to claim that it supports the absence of a trend when in fact it says the opposite (see items 76, 77).

Plagiarism

The definition and significance of plagiarism depends a lot on the context. In some cases there may be a clear breach of copyright. Universities expect originality from their students as proof of learning. In scientific publications, acknowledging sources is both an issue of ensuring proper credit for good work by the original workers and also for making it possible to back-track along a chain of references to find the original source when doubts arise.³³

Plimer has been accused of plagiarising a whole chapter of *Telling Lies for God*.

In *Heaven + Earth* a large number of the graphics have been taken from other sources without attribution. In the various examples where *Heaven + Earth* uses text from others without attribution, there has usually been some effort to tweak the words to make it look a little different.

Item 159 notes the unattributed source of the 'Graham Bank' story as:

<http://www.geolsoc.org.uk/gsl/geoscientist/media/page571.html>

Item 160 identifies the source for comparisons to 'Collegium Romanum' as:

<http://www.business-standard.com/india/storypage.php?autono=291379>,

Tim Lambert's blog discusses plagiarism in *Heaven + Earth* concerning analysis of Mauna Loa data at:

http://scienceblogs.com/deltoid/2009/10/plimer_the_plagiarist.php

Other cases in *Heaven + Earth* are:

134. p. 115 and p. 120: A preprint by O. Manuel, S. A. Kamat and M. Mozina is available from:

<http://arxiv.org/abs/astro-ph/0609509>.

Two sentences from the abstract are used exactly on pages 115 and 120 and others are reproduced in a modified form.

Plimer has a footnote (516) citing: Manuel [sic] ... *Astrophysics*, 654: 650–664. The paper by Manuel et al. actually appeared in a Russian journal *Phys. Atom. Nucl.* **69**,1847-1856, 2006³⁴.

³³Thus, the recent (Jan 2010) discovery of unsubstantiated claims about Himalayan glaciers in an IPCC report, was possible precisely because the IPCC reports do document the sources and so the claim about glaciers could be tracked back to a speculative article.

³⁴This item is edited from an account provided by Prof. Michael Ashley, UNSW.

135. p. 229: Differences of about 3% occur between the farthest point (aphelion) and the closest point (perihelion). This 3% difference in distance means that Earth enjoys a 6% change in solar activity between January and July. When the Earth's orbit is the most elliptical, the solar energy at the perihelion is some 20 –30% more than at the aphelion. These cyclical changes in the amounts of solar energy received by the earth influence climate. At present, the orbital eccentricity is nearly at the minimum of its cycle.

is remarkably similar to

Today a difference of only about 3 percent occurs between aphelion (farthest point) and perihelion (closest point). This 3 percent difference in distance means that Earth experiences a 6 percent increase in received solar energy in January than in July. This 6 percent range of variability is not always the case, however. When the Earth's orbit is most elliptical the amount of solar energy received at the perihelion would be in the range of 20 to 30 percent more than at aphelion. Most certainly these continually altering amounts of received solar energy around the globe result in prominent changes in the Earth's climate and glacial regimes. At present the orbital eccentricity is nearly at the minimum of its cycle. from:

<http://www.homepage.montana.edu/geol445/hyperglac/time1/milankov.htm>

Since the Montana document is undated, there is no indication who is failing to quote whom, but since the 6% variation is a change in *received solar energy* and not a change in *solar activity*, Plimer's version looks like a clumsy (minor) rewording of the Montana version.

136. pp. 457–461: The account of failed predictions of 'The End Of The World' closely follows Appendix 3 of *An Encyclopedia of Claims, Frauds, and Hoaxes of the Occult and Supernatural* by James Randi, from:

<http://www.randi.org/encyclopedia/appendix3.html>

Plimer starts with the same biblical 'prediction', and mostly follows Randi's list. Plimer's footnote 2200 recommends a 1990 book by James Randi as *A good summary of end of world ideas, some of which are used herein . . .* Not only 'the ideas' are used, but also some large chunks of sentences.

Contributed comments

This section contains contributions from Tim Lambert from the list on his Deltoid blog [TL], Steven Sherwood [SS], and Penny Whetton. The source of each item is indicated by the author's initials. This section and the following section have comments in outline form. Where I have expanded this type of contribution to a more complete version it is in the main list.

137. Figs. 1, 3 and 4 are all very inconsistent, esp. 1 and 4 which purport to use the same dataset (HadCRU3). [SS]
138. p. 113: claim that research shows cosmic rays are important for cloud formation are not supported by the cited studies; some of the studies (Udelhofen and Cess) claimed to support relationship between cloud and cosmic rays actually refute it — [SS].

139. p. 286: claims IPCC has no evidence to support statement that glaciers are retreating – see section 4.5 in TAR for evidence — [TL].
140. p. 316: Plimer claims that 1-m sea level rise would be consistent with post- glacial rise rate, but a few sentences later says that has been dropping for the last 3000 years not rising at all. In the next paragraph he claims that rates of change of several metres per century were common during the holocene, but the references quoted actually show that 1-m changes occurred in parts of Australia and that global sea level fell steadily over the last 6000 years by a total of 2m — [SS].
141. p. 367: confused about how the earth warms. How does he think a blanket works? — [TL].
142. p. 421: claims only 4% of CO₂ in atmosphere is from humans — [TL].
143. The chapter introductions (and concluding remarks of sections) contain many assertions and non sequiturs — things that are not supported by the chapter contents. Examples are the section ends on pages 170, 225, 267 and 298 — [PW].

Conduct of science

This section and the following section are split off in response to critics of early versions of this document, who felt that this sort of thing dilutes the arguments about science. Misrepresentations of the operation of the IPCC and the authorship of its reports are included here, while misrepresentation of the content of IPCC reports is in the main section.

144. p. 14: *Hypotheses are invalidated by just one item of contrary evidence* ... yes but only once it has been ascertained that the contrary evidence is being correctly interpreted.
145. p. 15: *Studies of the Earth's atmosphere tell us nothing about future climate* — so much for Plimer's claim that an inclusive approach is needed.
146. p. 15: *Collection of new scientific data by observation, measurement and experiment is now out of fashion* — patently ridiculous, given NASA budget, NOAA, CMAR, EU CarboEurope etc.
147. p. 15: Aristotle's principle quoted as *First we must seek the facts, then seek to explain* is one view — it contrasts to Charles Darwin's view that *a fact is of no value unless it is for or against some theory* [approximate wording].
148. p. 19: *In the 2007 report, the health effects of global warming were expertly dealt with by two lead authors, one of whom was a hygienist and another a specialist in coprolites (fossil faeces).*

The relevant chapter is *Human Health*, chapter 8 of the Working Group 2 contribution to AR4. The **eight** lead authors are: **Ulisses Confalonieri, Bettina Menne, Rais Akhtar, Kristie L. Ebi, Maria Hauengue, R. Savi Kovats, Boris Revich and Alistair Woodard.**

149. p. 25, footnote 25: Given Plimer's past interactions with religious groups, choosing the Washington Times as a source of his climate data seems strange.
150. p. 112: IPCC computers don't do clouds — totally unsurprising — IPCC computers don't do climate modelling — presumably they do things like e-mail, desktop publishing, accounting etc. The climate modelling used by the IPCC is done by major research groups using models that do include clouds — see item 68.
151. p. 437: Item 109 notes misrepresentation of the authorship of WG1 chapter 5 in the IPCC AR4 as well as misrepresentation of content.
152. p. 444: The IPCC claims that its reports are written by 2500 scientists. In fact they are written by 35 who are controlled by an even smaller number. As described on page 49, the IPCC gives specific directions as to who should be acknowledged as the authors. This is far fewer than 2500 people — the IPCC reports make no such claim as 2500. However, these acknowledged authors total far more than 35 people. The 'control' is unspecified. The real control on IPCC authors is the knowledge that their work will be widely read by scientific peers and that any errors will be widely publicised. — [also in TL list].
153. p. 445 the growth of the global warming industry has replaced the collection of primary field data, measurement and experiment. — essentially a repeat of the risible claim noted in item 146.
154. p. 454: On the subject of tide data: it is hard to market a publication to a journal editor on the basis that nothing has happened. The one time that a 'nothing happened' result is readily 'marketable' is when there is a wide-spread expectation that something would happen. The Michelson-Morley experiment (failure to detect Earth's motion through the ether) is a famous example. If the tide-gauge data really cast significant doubt on the mainstream view of human-induced climate change, then publication would be much easier.
155. p. 454: No scientific journal today would have published a paper submitted by an unknown patent clerk on a fundamental breathtaking new concept of physics. Einstein did have a few things going for him, beyond being an unknown patent clerk when he submitted his paper on relativity:
- i:** he had several papers previously published;
 - ii:** much of the mathematics already existed — Einstein's great insight was to understand what it meant. Indeed so much of the mathematics already existed that (a) the equations still carry the name 'Lorentz transformations'; (b) one strand of 'Aryan Science' argued that relativity was discovered by Lorentz rather than the Jewish Einstein (although the more common 'Aryan Science' view was to dismiss relativity as 'Jewish superstition');
 - iii:** Einstein had under simultaneous consideration a paper on the photo-electric effect that appeared less confronting, but of a quality that gained Einstein the Nobel Prize in physics.³⁵

³⁵The 'less confronting' was only appearance — quantum mechanics, which followed from work such as Einstein's analysis of the photo-electric effect, was so weird that Einstein never fully accepted it.

156. p. 454: Some 50 or 100 years ago, great science breakthroughs were common events. Not so today. This seems to ignore the sequencing of the genome of *homo sapiens* (and other species); discovery of a new state of matter (the Bose-Einstein condensate); discovery of extra-solar planets; cloning mammals; new allotropes of carbon (buckey-balls etc.) and the proof of Fermat's last theorem.

Some silly stuff

157. p. 20: [on IPCC authors, apparently meaning the 'contributing authors'] Some of them used their given name in one part, used an initial in another part and an abbreviation in another. Apart from the incorrect assertion that these people 'used' their names (it was the lead authors — those who wrote the chapters — or the editors, who would 'use' the names of contributors), this sort of ambiguity is extremely common. For example, the book *Heaven + Earth* by **Ian** Plimer, cites as reference the books *A Short History of Planet Earth* — [footnote 564] and *Telling Lies for God* — [footnote 2202] both by one **I.R.** Plimer.

158. p. 83, footnote 345: Deducing climate trends from paintings of clouds is fraught with problems (and essentially restricted to Europe). Previous studies of cloud paintings have analysed fractal dimension to show bias in representation — painters choose 'interesting' clouds, reflecting what Plimer notes as the role of artistic license. Also fashions change. Turner's Val d'Aosta would probably not have been painted in an earlier time and prior to Mark Rothko and like-minded artists, a painting of marine stratus would be unlikely to have been regarded as art.

159. p. 362–363: The story of 'Graham bank', the volcanic island that rose and sank, adds nothing to the argument. The claim The rock is worth nothing, is of no use as a territorial possession... is questionable. Territorial possession of various small outcrops around the world is asserted as the basis of exclusive economic zones, e.g. for fishing and oil extraction — [PW]. The words quoted above come from a novel about the events of 1831 (when Graham Bank appeared and was named) which was quoted in an article *From out of the azure main* at: <http://www.geolsoc.org.uk/gsl/geoscientist/media/page571.html> on which Plimer's account draws heavily, without attribution.

160. p. 463: After claiming that Human-induced global warming ... has become an article of scientific dogma. Plimer goes on to assert: The peer review process in climatology research is controlled by the secular equivalent of the Collegium Romanum, the IPCC. They in turn are answerable to the Inquisition, the global warming fundamentalists, This last part is plagiarised from: <http://www.business-standard.com/india/storypage.php?autono=291379>,³⁶ with some minor changes of words, but no citation. — [DK].

161. p. 464: Giordano Bruno was burned at the stake for supporting the Copernican theory of a Sun-centred universe. This one is trotted out from time to time by those who try to

³⁶Story by Deepak Lal, dated July 17, 2007, downloaded by IGE 2009/10/27.

claim that rejection of their claims represents prejudice rather than reasoned arguments. An article, *The Copernican Myths*, in the December 2007 of *Physics Today* notes that Bruno was condemned mainly for theological heresies. The follow-up correspondence in *Physics Today* captured more of the complexity of the myths of science vs. religion, containing the hint that the myths were fostered by Catholics and Protestants each trying to paint the other side as the ‘bad guys’ A new biography³⁷ of Bruno (*Giordano Bruno: Philosopher/Heretic*, by I. D. Rowland) lists his offences as: refusing to accept the transformation of the mass into the body of Christ, arguing that hell did not exist and that no-one is damned to eternal punishment, asserting that praying to saints was a waste of time and that no church beliefs could be proved. Rowland also proposes that the legend of Bruno as a martyr for science was largely a 19th century construct of the emerging Italian state in its battles with the Vatican.

162. p. 467: *The environmental religion has no music ...* — how could anyone forget about Peter Garrett??
163. p. 468: *Sustainability creates a miserable existence, poverty, disease, depopulation and ignorance.* Historical evidence would suggest that these are the consequences of unsustainability.
164. p. 468: *Self-denial and a return to the past led to the 600-year Dark Ages. . .* — a remarkable assertion of human influence on climate?

Editorial

This section is included mainly to aid those who want to check my claims in tracking down items that are incorrectly referenced.

- Author’s name should be G. S. Callender on p 17.
- For reference 220, the correct volume is 213, not 2134 and first page is 63, not 53.
- Referencing seems wrong; discussion of Svalbard linked to reference 304, but actual paper with Svalbard data is 305.
- Footnote 1253 (page 251) gives title only, with no bibliographic details
- Ref. 1778: Volume, page numbers cited correspond to paper with completely different title.
- Authors’ names should be Bacastow, Keeling and Whorf in footnote 2093.
- Footnote 2237 gives the wrong page number.
- See item 134 for Michael Ashley’s comment on referencing of the ‘iron Sun’ claim.

³⁷Versions up to 2.1 used the review (in *Physics Today*, (September 2008) at this point.

Other critiques

- The book review *No Science in Plimer's Primer* by Michael Ashley picks up on issues such as the temperature data, CO₂ measurements and in particular some of Plimer's weirder claims about the composition of the Sun (page 116). I have noted some such issues on CO₂ measurements as items 89, 90, 91 and 93 — see also index. The index also indicates various issues regarding temperature data.
<http://www.theaustralian.com.au/news/ian-plimer-heaven-and-earth/story-e6fgr8no-1225710387147>
- Robert Manne, writing in the *Weekend Australian* of 25–26/4/2009 as *Zealotry not in the public interest*, presented the view of someone who, like most of the public and the editors of the *Australian*, is not an expert on climate science. He suggested that the public (and editors) cannot rationally choose to believe the views of a *handful of pseudo-sceptics rather than those of tens of thousands of scientists researching and publishing in this field*. Noting the role of *industries that rely on fossil fuel emissions* he asserted that *Pseudo-sceptical scientists such as Plimer, who falsely help convince citizens that the scientific knowledge in this field is fiercely disputed and basically unsettled, are among their most valuable assets*.

Responses to this column included:

a: An editorial *Too much hot air in climate change row* in *The Australian* 28 April 2009, with the sub-title *The evidence for man-made global warming is equivocal* and, describing Plimer as *a leading academic geologist* admonished Manne and concluded that Plimer's view *is not to be dismissed as the 'zealotry' of a 'pseudo-sceptical scientist'*.

b: A column *Chairman Manne's no to climate dissent* in *The Weekend Australian: 2–3 May 2009*, which queried the *a handful of pseudo-sceptics rather than those of tens of thousands of scientists* description, but which otherwise was a wide-ranging attack on Manne that failed to address any of Manne's criticisms of *Heaven + Earth* and the coverage by *The Australian*.

- The Australian Science Media Centre (AusSMC) posted summary comments from 7 experts (Professor Colin Woodroffe, Professor Matthew England, Dr Graeme Pearman, Professor Nathan Bindoff, Professor Barry Brook, Dr Harvey Marchant and Ian Lowe) at: <http://www.aussmc.org/IanPlimerclimatebook.php>
- Andrew Glikson published *Plimer wants to talk science? OK, here goes...* in *Crikey* (2009/5/5):
<http://www.crikey.com.au/2009/05/05/plimer-wants-to-talk-science-ok-here-goes/>
- An article *Geology points to dangers ahead*, by Mike Sandiford was published in *The Australian* (2009/5/6). He pointed out that the last time that there was so much CO₂ in the atmosphere was in the Pliocene 5 million years ago when seas were so much higher that they flooded much of the Murray basin.
<http://www.theaustralian.news.com.au/story/0,,25434629-7583,00.html>
- Geologist, Prof. Malcolm Walter discussed *Heaven + Earth* on *The Science Show* (broadcast 2009/6/6) describing it as *a mass of only partly digested material and poorly ex-*

pressed opinions concluding he has done a disservice to science and to the community at large. Transcript at: <http://www.abc.net.au/rn/scienceshow/stories/2009/2586947.htm>

- David Karoly reviewed *Heaven + Earth* on *The Science Show*, broadcast 2009/6/13, noting in particular that *Many of the figures have mistakes, either in the caption or in the data, and have no sources provided.* His conclusion began: *Given the errors, the non-science, and the nonsense in this book, it should be classified as science fiction in any library that wastes its funds buying it.* The transcript is at: <http://www.abc.net.au/rn/scienceshow/stories/2009/2593166.htm>

- In Melbourne, *The Age* published a review by Prof. Chris Turney from the University of Exeter on June 27 2009, under the title *Greivous heavenly harm*, strongly critical and noting ... *the litany of misleading statements in Heaven + Earth is disturbingly high: ...*

- Professor Kurt Lambeck, president of the Australian Academy of Science, was interviewed on *Ockham's Razor* on 7 June 2009. Transcript at: <http://www.abc.net.au/rn/ockhamsrazor/stories/2009/2589206.htm>

Going straight to the point, he noted *Heaven + Earth is not a work of science.* He identifies *a number of issues which, while in isolation could be seen as minor, collectively indicate carelessness at best, and at worst an attempt to undermine the integrity of the science case.*

- The transcript of a *Lateline* interview (where Ian Plimer tries to evade this issue of US vs. global temperatures — see item 34) can be found on: <http://www.abc.net.au/lateline/content/2008/s2554129.htm>

- Tim Lambert's Deltoid blog begin with *The science is missing from Ian Plimer's "Heaven and Earth* Posted on: April 23, 2009 2:26 PM, by Tim Lambert at: http://scienceblogs.com/deltoid/2009/04/the_science_is_missing_from_ia.php

- Tim Lambert's blog:³⁸ continued *I cross referenced Ian's list of 33 problems [i.e. version 1 of the present document] with my own list of 59 and there were only 5 things in common. So I can estimate the total number of errors if I assume that we have produced independent samples from the population of Plimer errors: $(33 \times 59) / 5 = 390$ problems. Almost one for every page! Blogged at: http://scienceblogs.com/deltoid/2009/05/ian_enting_is_checking_plimers.php*

As well as 5 being a small sample, there are a lot of reasons why the samples are **not** independent — some would lead to lower estimates, some to higher estimates. There are additional comments by Tim and myself on Tim's blog, but the bottom line is not to take the number seriously. (Of course after version 1.2, the lists stop being independent.)

- Tim's blog has continued with additional analysis of Plimer's book. Two significant contributions are:

³⁸In his series on *The Australian's War on Science*.

- *Plimer the plagiarist*, blogged at:
http://scienceblogs.com/deltoid/2009/10/plimer_the_plagiarist.php
 discussing the analysis of Mauna Loa CO₂ data;
 and
- *Plimer exposed as a fraud*, blogged at:
http://scienceblogs.com/deltoid/2009/12/plimer_exposed_as_a_fraud.php
 discussing the Plimer-Monbiot debate on the ABC.
- Barry Brook's *Brave New Climate* blog began shortly after the launch. Barry also kindly mirrored the various versions of my analysis. The starting point is:
<http://bravenewclimate.com/2009/04/23/ian-plimer-heaven-and-earth/>

A number of the early reviews were reprinted in *The Australian Geologist* September 2009 issue.

Defences of Plimer

In Australia, much of the media support for *Heaven + Earth* came from *The Australian*. The editor Chris Mitchell has won the 2009 APPEA JN Pierce Award (from the Australian Petroleum Production & Exploration Association) for Media Excellence for coverage of climate change policy:

http://www.appea.com.au/content/pdfs_docs_xls/NewsMedia/APPEAMediaReleases/2009_Conference/APPEA%20Media%20Release%20-%20090601%20-%20JN%20Pierce%20Award.pdf

noting that *Several correspondents at The Australian including Michael Stutchbury, Lenore Taylor, Matt Chambers, Cath Hart and Matthew Warren, were judged to have significantly contributed to this very high standard of journalism.*

- A extensive supporting statement on the back cover by Václav Klaus (at the time President of the European Union) praises the book as powerful clear understandable and extremely useful.
- Similarly, on the back cover Nigel Lawson (Lord Lawson of Blaby) describes the book as a scrupulous and scholarly analysis of both the climate science and what is truly known of climatic history...
- Writing in the *Australian* (2009/4/18) Christopher Pearson noted that he would be MC at the Adelaide launch³⁹ predicting that *for national debate ... in all likelihood 2009 will be seen as the turning point and divided into pre and post-Plimer eras*. The majority of Pearson's article picks up on Plimer's assertion that concerns about global warming represent a substitute religion.
- In the Brisbane launch (2009/5/19), Senator Ron Boswell observed⁴⁰ *Regardless of Copenhagen our ETS will impose a carbon cost on our business which our trading competitors*

³⁹This was the first time I heard of *Heaven + Earth*.

⁴⁰Downloaded from ronboswell.com, 2009/06/26.

*will not have to pay. We have to move heaven and earth to stop this happening. Reading 'Heaven and Earth' is one way to begin.*⁴¹

- Writing in *The Australian* on (2009/5/18), Janet Albrechtsen attacked criticisms of Plimer, saying to *cast his book aside as an unworthy contribution to this debate tells you something about the stifling consensus and what Plimer rightly calls the 'demonisation of dissent' on this critical issue.*

<http://www.theaustralian.com.au/news/a-tale-of-two-worlds/story-e6frg6qx-1225713128434>

- In a press release on 21 April 2009, the National Farmers' Federation *welcomed Prof Ian Plimer's contribution to the climate change discussion and debate concluding Rigour underpins getting the science right ... Prof Plimer is part of the mix.* Since Plimer exaggerates the significance of cows relative to cows by a factor of 400 or more (item 105), this 'welcome' by the NFF seems surprising.

- William Kininmonth had a letter published in *The Weekend Australian* of 30–31 May 2009, generally supporting Plimer and *The Australian's* coverage of climate issues. Four of the other five letters published that day on the issue were critical of Plimer.

- http://www.sydney.catholic.org.au/people/archbishop/stc/2009/2009524_1018.shtml is a post (2009/5/24) by Cardinal George Pell, Archbishop of Sydney, supporting *Heaven + Earth*, claiming that temperatures were five or six degrees higher than today in Roman and Medieval times and concluding that *Evidence shows the wheels are falling off the climate catastrophe bandwagon.*

More recently, Cardinal Pell has had a letter included in Hansard, extensively repeating many of Plimer's unsupported claims (and adding the claim that nitrogen is a greenhouse gas!).

<http://www.aph.gov.au/hansard/senate/commtee/S13298.pdf>, pp143–145.

This claims have been extensively rebutted by Dr. Greg Ayers, head of the Bureau of Meteorology, during Senate Estimates Committee hearings. An account of Pell's response was reported at:

<http://www.smh.com.au/environment/climate-change/pell-row-with-climate-scientist-heats-up-20110313-1bsx6.html>

- An article *Meet the man who has exposed the great climate change con trick* by James Delingpole in *The Spectator* appeared on 8 July 2009:
<http://www.spectator.co.uk/essays/all/3755623/meet-the-man-who-has-exposed-the-great-climate-change-con-trick.shtml> supporting *Heaven + Earth* with extensive quotes from Plimer.

⁴¹Far from promoting open discussion of the claims, launching *Heaven + Earth* in the context of a current party political debate had the effect of precluding some of the largest groups of climate scientists in Australia, those in CSIRO and the Bureau of Meteorology, from commenting, except as individuals in their private capacity. Added in version 2.1: Since this footnote was first written, CSIRO guidelines appear to have been changed to place restrictions on CSIRO scientists commenting on policy debates even in a private capacity. The case of Dr. Clive Spash, whose paper on ETS appears to have been caught up in this change, gained extensive media coverage.

- Emeritus Professor Frank Larkins reviewed *Heaven + Earth* for the October 2009 issue of *Chemistry in Australia*. He notes *His critics justifiably highlight that his arguments lack balance and scientific rigour...* and notes the present document⁴². He summarises many of Plimer's arguments and repeats a number of Plimer's claims about failings of the international science community. He concludes that *The book is essential reading for anyone interested in gaining an insight into one view of a complex global scientific problem for which the final chapter has not yet been written.*⁴³
- A 4 Corners program (broadcast 2009/11/09) regarding negotiations on emissions trading legislation, included the exchange:

<http://www.abc.net.au/4corners/content/2009/s2737676.htm>

SARAH FERGUSON: The most vocal liberal sceptics didn't go to the meeting, they don't accept the science being presented here or the conclusions of the international panel on climate change.

TONY ABBOTT⁴⁴: I think that in response to the IPCC alarmist - ah in inverted commas - view, there've been quite a lot of other reputable scientific voices. Now not everyone agrees with Ian Plimer's position but he is a highly credible scientist and he has written what seems like a very well argued book refuting most of the claims of the climate catastrophists.

During the course of the 2010 federal election in Australia, Mr. Abbott (at that time leader of the opposition) was asked in a television interview whether he still endorsed Plimer's book. Mr. Abbott managed to evade the question.

A number letters defending *Heaven + Earth* were reprinted in *The Australian Geologist* September 2009 issue along with some of the early reviews noted in the previous section.

One notable point is that, with the exception of William Kininmonth, Plimer's fellow 'sceptical scientists' seem to have been reluctant to come to his support.

The description of Plimer on the website of the Australian Climate Science Coalition includes:⁴⁵

Prof. Plimer's current duties at The University of Adelaide are more that of an entrepreneur, promoter, inspirer of young students and staff, university public face and political lobbyist rather than that of a traditional academic. Prof. Plimer teaches the first year geology and second year geology for engineers courses (Science) and the first year introduction to mining engineering and second year economic and mine geology courses (Engineering). Much of his time is spent showing state and federal politicians, international delegations, scientists, student groups and resource companies the Broken Hill orebody, the mass of rock that led to the industrialisation of Australia.

Plimer's responses

- Plimer's op-ed *Hot-air doomsayers in The Australian* (2009/5/5) has the subheading *Geologist Ian Plimer argues that critics of his climate change book should respond with*

⁴²Probably version 1.9 or 2.0.

⁴³In one sense, *Heaven + Earth* is 'essential reading' since it clearly demonstrates the extent of fabrication and mispresentation in the case against the science of anthropogenic global warming. Maybe this is what Prof. Larkins meant.

⁴⁴As identified earlier in the transcript, Mr. Abbott was at that time Shadow Minister for Families and Housing.

⁴⁵Downloaded from http://www.auscsc.org.au/about_us.html, 2010/1/1.

science. He asserts that No critic has argued science with me. He rejects David Karoly's claim that the book is not supported by sources.⁴⁶

- In *Vitriolic climate in academic hothouse* (May 29, 2009 in *The Australian*) Plimer attacks his critics. Using almost exactly the same words as in the Kininmonth and Aitken letters to Lambeck he asserts There has never been a climate debate in Australia. Only dogma. His response to criticisms⁴⁷ is In my book I correctly predicted the response. The science would not be discussed, there would be academic nit-picking and there would be vitriolic ad hominem attacks by pompous academics out of contact with the community.

- Plimer had a letter published in the 2009/10/3 edition of *Silicon Chip*: http://www.siliconchip.com.au/cms/A_111681/article.html with a covering editorial endorsing it: http://www.siliconchip.com.au/cms/A_111680/article.html — [MA].

Plimer's letter includes comments that seem to go beyond what is in his book, referring to previous warmings with an atmospheric temperature some 5°C higher than now (eg, Minoan, Roman, Medieval). . . and claiming Five of the six major ice ages occurred when the atmospheric CO₂ content was up to 1000 times higher than at present Of course the use of up to 1000 times higher makes this statement rather meaningless — it can include cases, e.g. quaternary glaciations, when CO₂ was lower than at present.

- The program *Professor Ian Plimer replies to his critics* was broadcast on *Ockham's Razor* on October 18, 2009. Much his reply consists of repeating claims in *Heaven + Earth*. Some of his comments on criticisms are:

Great institutions such as the ABC, CSIRO, some professional societies and academies and many university institutes have now become totally politicised.

Dispassionate, independent, fearless advice from government departments now no longer seems possible.

I never thought I would see the day when the only balance on a matter of science derives from commercial radio.

Major capital city newspapers promote a doom and gloom scenario and The Australian valiantly tries to present a diversity of opinions.

Polemical criticism of my book Heaven and Earth has been savage because there are a large number of career climate comrades who frighten us witless about climate change and who would be unemployable outside taxpayer-funded climate institutes.

The total politicisation of science, as demonstrated by the use of consensus and 'the science is settled' has been easy because of the dumbing down of the education system, the lack of critical and analytical thinking and instant information, most of which is unvalidated.

and later These are the same folk that brought us toxic derivatives and now they want to impose a guilt tax on the very substance that allows life on Earth.

⁴⁶Karoly has particularly noted the lack of attribution of sources in most of the graphics.

⁴⁷Like many of the footnotes of *Heaven + Earth* this 'quote' is quite non-specific and I have been unable (as at March 23, 2011) to find such a prediction in *Heaven + Earth*.

From my experience of challenging creationism, I argue that the global warming movement is an ascientific urban religious fundamentalist movement detached from the environment.

Adherents uncritically accept information from the web, Wikipedia and blog sites, yet have little knowledge of integrated interdisciplinary science.

They anonymously criticise my book *Heaven and Earth*, but have not read it.

None of this addresses the criticisms from those, like myself, who do not hide behind anonymity.

Transcript at:

<http://www.abc.net.au/rn/ockhamsrazor/stories/2009/2716078.htm>

Monbiot vs Plimer

George Monbiot's engagement came in response to the 2009/7/8 article by James Delingpole in *The Spectator*. Monbiot responded with an article *Spectator recycles climate rubbish published by sceptic* in the *Guardian* on 2009/7/9:

<http://www.guardian.co.uk/environment/georgemonbiot/2009/jul/09/george-monbiot-ian-plimer>

This led to an extensive correspondence, both published and by e-mail, between Monbiot, Plimer and *The Spectator*.

Some of the steps were:

- Plimer challenged Monbiot to a debate
- Monbiot agreed subject to the condition of Plimer's answering a set of written questions (some based on earlier versions of this document);
- Plimer responded by proposing his own set of questions and the proposed debate in the UK did not happen.

A number of scientist have prepared answers to Plimer's questions. One example is on the *RealClimate website* where the questions are ranked as to both relevance (mostly very low) and for whether they make sense:

<http://www.realclimate.org/index.php/archives/2009/08/plimers-homework-assignment/>

A debate of sorts was broadcast on the ABC program *Lateline* on 2009/12/15, (transcript and link to vodcast):

<http://www.abc.net.au/lateline/content/2009/s2772906.htm>

In this broadcast, Plimer was asked about two specific issues. The first was that his claims about CO₂ from undersea volcanoes contradicted surveys by the US Geological Survey. The second concerned Plimer's citation of a paper by Keller (footnotes 1710 and 1718) with Plimer had reversed what was said in his cited reference (see items 76, 77). This behaviour was described as fraud. Plimer's evasion of these questions is reproduced here with the permission of the producer.

TONY JONES: OK. Alright. I'm gonna stick to some of the questions that Mr Monbiot's been asking you. The issue of measuring temperatures at the heart of this. Once again, you take issue with Ian Plimer's claim that satellites and radio sons⁴⁸ show there is no global warming. Tell us why?

⁴⁸This should be radiosondes (IGE).

GEORGE MONBIOT: Yes, well this is fascinating, because he for once gives a reference to that claim, so you're able to go back and check the reference and see if indeed it says what he says it says. And do you know what, it says precisely the opposite of what he says. It's a paper by Charles F. Keller and it said that the recent data from satellite and radio sons, which are weather balloons, the recent data blows away the contention that there has been no further warming. And what does Plimer do? He takes that bit, saying, "No further warming," and suggests that the paper is claiming that the satellites and radio sons show there's been no further warming. Again, turning round the conclusions 180 degrees, straightforward scientific fraud.

TONY JONES: Alright. We're nearly out of time, but I'm gonna have to get you to respond to that. This is a paper you do quote by Charles Keller. You stand by your quotation.

IAN PLIMER: There is a dispute on how you tweak the satellite data. And that can give you the answer you want. We know from measuring temperature at thermometer sites that's totally unreliable as well.

TONY JONES: Can I just ask, do you stand by your selection of the Keller quote?

IAN PLIMER: Selection: I think that's a very moralistic word. I have scanned ...

TONY JONES: But you've only taken a part of the overall ...

IAN PLIMER: Which page are we talking about?

TONY JONES: Yes, it's page 383.

GEORGE MONBIOT: You turned it around 180 degrees. You actually made up - you made up the conclusion to what the paper said.

IAN PLIMER: 383. And it's about the treatment of data. Well the treatment of the data is very interesting. For example, we go to any measuring site, and I've got one here for Mildura showing that there are 11 changes since we started to measure data there. That's unreliable.

TONY JONES: OK. But just a quick question.

GEORGE MONBIOT: Answer the question, Professor Plimer.

TONY JONES: I'm sorry, we're nearly out of time, so, I have to just ask you ...

IAN PLIMER: It's quite interesting the way that journalists handle science. If you don't want to hear the message, you bully people.

GEORGE MONBIOT: You made up what the reference said. Answer the question. Answer the question.

IAN PLIMER: You want to bully people rather than deal with evidence.

TONY JONES: George Monbiot, just hang on. Sorry.

IAN PLIMER: Now, there is an enormous ...

GEORGE MONBIOT: We are pressing you ... OK ...

IAN PLIMER: For God sake, get some manners young man. There is an enormous dispute as to how

...

GEORGE MONBIOT: We are pressing you ...

TONY JONES: George Monbiot, hang on a second, please.

IAN PLIMER: ... you measure temperature from satellites, because you have to put a huge number of corrections there. That is what I question, is one paper that might have one set of corrections and another paper that might have another set of corrections. And this is the same way temperature is measured. The same with ground temperatures. We have ground temperatures that get corrected all the time. But again, you are looking at the last few years, you're not looking back in time where every temperature change and every climate change has been more rapid and greater than ever we see today.

GEORGE MONBIOT: You are evading the question. The question was ...

TONY JONES: George Monbiot, a final point. Sorry, we're nearly out of time.

GEORGE MONBIOT: Sure, sure. A classic example of Professor Plimer evading the question. The question was: did you reverse the findings of the reference that you cited. Answer: yes he did. But will

he answer that question? The heck he will. And it is, again, I say, the height of bad manners not to answer the very straightforward question which has been put to you, but you can't answer it because you have made up the facts.

IAN PLIMER: And why does Mr Monbiot use blog sites where the bloggers are paid to smear scientists. ...

GEORGE MONBIOT: Again, pure distraction. You are again evading the question, you are evading the issues. It's just a fascinating exercise in evasion and distraction. Why won't Professor Plimer ever answer the straightforward questions that are put to him?

IAN PLIMER: Well let me give you a straightforward question.

TONY JONES: OK, I'm sorry. I'm gonna have to cut it off there ...

Additional information

The *RealClimate* website provides links to various critiques of *Heaven + Earth*.

http://www.realclimate.org/wiki/index.php?title=Ian_Plimer

The *Wikipedia* article on *Heaven + Earth* has links to many comments on the book.

Temperature data

Normal practice, appropriate for a scrupulous and scholarly analysis, is to reference the original sources of data that are used. One reason for this is to simplify the process of checking — facilitating the usual and genuine scepticism in science. The other reason is to ensure that those who did the real work get the credit. This is becoming increasingly important as computer-generated metrics are increasingly applied to decisions on funding and career advancement.

Several of the analyses in this document use data downloaded from:

<http://www.cru.uea.ac.uk/cru/data/temperature/>

- file hadcru3gl.txt, downloaded 2009/6/1, is monthly global mean temperature anomalies.

The website from which the data were downloaded indicates that the appropriate scientific citations for these data are:

- Brohan, P., J.J. Kennedy, I. Harris, S.F.B. Tett and P.D. Jones, 2006: Uncertainty estimates in regional and global observed temperature changes: a new dataset from 1850. *J. Geophysical Research* **111**, D12106, doi:10.1029/2005JD006548 — Available as PDF.
- Jones, P.D., New, M., Parker, D.E., Martin, S. and Rigor, I.G., 1999: Surface air temperature and its variations over the last 150 years. *Reviews of Geophysics* **37**, 173-199.
- Rayner, N.A., P. Brohan, D.E. Parker, C.K. Folland, J.J. Kennedy, M. Vanicek, T. Ansell and S.F.B. Tett, 2006: Improved analyses of changes and uncertainties in marine temperature measured in situ since the mid-nineteenth century: the HadSST2 dataset. *J. Climate*, **19**, 446-469.
- Rayner, N.A., Parker, D.E., Horton, E.B., Folland, C.K., Alexander, L.V, Rowell, D.P., Kent, E.C. and Kaplan, A., 2003: Globally complete analyses of sea surface temperature, sea ice and night marine air temperature, 1871-2000. *J. Geophysical Research* **108**, 4407, doi:10.1029/2002JD002670.

Climate sensitivity

The climate sensitivity is defined as the amount of equilibrium warming caused by a doubling of CO₂ (or equivalent change in radiative forcing). Over the concentration range of most interest, this relation can be approximated as a logarithmic function (as Plimer acknowledges on page 338). Thus about the same warming is expected for doubling from 200 ppm to 400 ppm as from 300 ppm to 600 ppm. Denoting the climate sensitivity as X , means that the temperature change as a function of concentration change from C_1 to C_2 can be written as:

$$\Delta T_{1,2} = T(C_2) - T(C_1) = X[\log_2(C_2) - \log_2(C_1)] = X \times \log_2(C_2/C_1)$$

This logarithmic relation has been known since the time of Arrhenius (1896) (who estimated $X = 5^\circ\text{C}$). It can be written in terms of natural logarithms (logarithms to base e) as

$$\Delta T_{1,2} = X[\log_e(C_2) - \log_e(C_1)] \times \log_2 e \approx 1.44X \times \log_e(C_2/C_1) = 1.44X \times \ln(C_2/C_1)$$

The IPCC has given a range of 1.5°C to 4.5°C . James Hansen (e.g. Bjerknes lecture at 2008 AGU Fall Meeting) estimates $X = 3.0 \pm 0.5^\circ\text{C}$. The logarithmic relation won't apply at low concentrations — a linear dependence is expected. The logarithmic dependence will also break down at sufficiently high concentrations.

Plimer's treatment of this lacks consistency. On a number of occasions he claims $X = 0.5^\circ\text{C}$ (e.g. page 488), while on page 426 (see item 104) he claims 1.5°C , and his example above (see item 124) of 7°C for 20 times CO₂ implies 1.61°C . (Note that since a division of logarithms is involved, the result of the calculation $7 \times \log(2.0)/\log(20.0)$ does not depend on what base is used for the logarithms, as long as the same base is used in both cases).

For a fixed initial concentration C_1 , one can look at how much the temperature increases for each unit increase in the concentration, C_2 :

$$\frac{\partial}{\partial C_2} T_2 = \frac{1.44X}{C_2}$$

This will have units of degrees C per unit of CO₂. Plimer's plot in figure 50 (page 375) which lacks any supporting citation, seems to reflect this (remembering that the $\frac{\partial T}{\partial C} \propto 1/C$ relation won't apply at low concentrations) with:

- taking the CO₂ unit as 20 ppm jumps as implied by the bars (i.e. the plot is of temperature increase for each extra 20 ppm CO₂);
- assuming that $X = 0.5^\circ\text{C}$;
- incorrectly omitting the factor of 1.44 (i.e. $\log_2 e$) that comes from going from base-2 to base- e logarithms.

Accuracy Precision and Standards

All scientific measurements are subject to error. Even when an instrument repeatedly measures the same object or sample, the results will not all be the same. For example Bischof [reference

2094] reported a precision of ± 3 ppm for measurements of CO₂ made by the chemical method. In contrast using the Infra-Red Gas Analyser (IRGA), they found a precision of ± 1 ppm for measurements of CO₂.

While precision quantifies the measurement-to-measurement repeatability, a serious concern for any measurement is the question of ‘accuracy’. Do all the measurements exhibit a systematic bias, such that the (average) measured value differs from the true value of what is meant to be measured?

Many measurements actually involve comparison of a sample to a standard. Consequently the accuracy of such a measurement is tied to the accuracy of the standard. Thus when Bischof switched to using the more precise IRGA method, he could cross-calibrate with the chemical method. (Averaging multiple chemical measurements of the standard will overcome the inherently lower precision of the chemical method). Thus Bischof’s agreement between chemical and IRGA measurements could be essentially guaranteed. However in producing standards for their IRGA program, Bischof’s group used an independent approach based on manometric techniques — mixing gases from precisely calibrated volumes (described in the same issue of *Tellus* as Bischof’s paper). Bischof’s ability to merge results from the two techniques represents a validation of the type that Plimer claims did not exist. The independent check on the accuracy is provided by the agreement of the Bischof’s higher altitude results [see reference 2095] and Keeling’s results from Mauna Loa — both indicating about 315 ppm. Keeling also prepared his standards using manometric techniques.

Historical periods

Heaven and Earth has five sections on temperatures in historical times headed:

The Roman Warming (250 BC – 450 AD) pages 59 to 60 and citing references 213 to 222.

The Dark Ages (535 AD – 900 AD) – a period of cooling – pages 61 to 63, citing references 223 to 238.

The Medieval warming (900 – 1300 AD) pages 63 to 72 citing references 239 to 295.

The Little Ice Age (1280 – 1850 AD) pages 72 to 86 citing references 296 to 367.

The late twentieth century warming (1850 – present) pages 86 to 87 citing references 368 to 369.

These sections are followed by a cross-cutting review, **The long tale of the lone pine**, (pages 87 to 99 and citing references 370 to 400) primarily addressing the ‘hockey-stick’ controversy.

While specific misrepresentation are noted in the point-by-point analysis, this section addresses whether the body of evidence presented in *Heaven and Earth* supports the claims of large globally-coherent temperature swings with extended periods much warmer than the present.

These first four periods (denoted RW, DA, MWP and LIA) are alleged to be globally synchronous periods of alternating warm-cold-warm-cold times, but a significant fraction of the evidence contradicts this. Contradictory examples cited by Plimer are:

- for Quebec ‘severe cold from 1025 to 1400 representing the Little Ice Age’ (p70 citing ref 280).
- For Sierra Nevada ‘dense forests grew above the current tree line during the Roman

Warming and from 400 AD to 1000 AD.

- P65, citing ref 246, argues for a 1500 year cycle (as does Fred Singer's book). If this applied with middle of LIA (1650) as peak low: (a) we could expect allegedly natural warming for another few centuries (b) Roman times (150 AD) should have been exceptionally cold.

Misrepresentations in these sections already noted above are:

- misrepresents what ref 217 states about RW;
- reference 239 contains only one (Central England) temperature series;
- extensive misrepresentation of data from reference 255;
- incorrect claim about borehole data in ref 256;

Of the footnotes 213–400 there are a number of repeated references (and a few footnotes that are definitions and not references).

It has not been possible to access every reference cited by Plimer in these sections. Those that have been accessed are listed below. The selection emphasises the most recent work, since that is in general more readily available in electronic form.

'Roman warming'

- 214** seems to misunderstand the significance of the sea-level changes reported by Lambeck et al. [2004], but the important point is that this paper does not present estimates of temperatures.
- 215** This reference does not report estimated temperatures — the majority of the records do not extend back into Roman times.
- 216** Lebreiro et al. [2006] does not really estimate temperatures. It looks for climatological variation indicated by marine sediments. It shows the most distinct change as occurring between the MWP and LIA with the two sets of cores showing (opposite) changes between fluvial vs open ocean regimes at this time. In general much of the variation is identified as due to local influences rather than global temperature. In particular they note that "The DA could have been as warm as the MWP."
- 217** Lamb [1977] – the actual statement in Lamb's book concerning Roman times is that 'it may well have been warmer than now' – where 'now' refers to some time before 1977.
- 219** As indicated by its title, reference 219 [Badal et al., 1994] addresses the period prior to 4000 BP and does not address Roman times.
- 220** Desprat et al (incorrectly cited as vol 2134, rather than 213) do not report any temperature estimates from their pollen data.

- 221** Retti-Shati et al. [1998] give a record from Mt Kenya. This shows a warm period (approx 100 BC to 500 AD) relative to earlier and later times, but is not calibrated to present temperatures.
- 222** On the basis of seal distributions, Hall et al. (2006) identify various warm periods: 'including a previously unrecognized period from 1,100 to 2,300 ¹⁴C yr B.P.' i.e. their warm period spans both Plimer's Roman warming and the Dark Ages, but do not give actual temperature estimates.

Thus as noted in item 19, none of the primary literature cited by Plimer in this section provides any temperature estimates anywhere to support the statement *Temperatures in the Roman warming were 2 to 6°C warmer than today.* made on p. 59. Similarly, as noted in item 123, the references cited on p. 490 for temperatures 3°C warmer do not support such a claim.

Dark Ages

- 224** Reference 224 [Baillie, 1994] considers only a decadal scale cooling, commonly associated with a possible 546 AD volcanic eruption, noting issues such as the longer duration implying the possibility of multiple eruptions, c.f. the absence of acidity signals in ice cores.
- 231** Reference 231 [Reyes et al., 2006] describes expansion of US glaciers, but for many the expansion began as early as 200 AD.
- 232** Footnote 232 references the paper by Hodell et al. [1995]. The paper addresses aridity rather than temperature. The dry period associated with Mayan collapse was 800–1000AD (spanning Plimer's 'Dark Age' and 'MWP').
- 238** This study of sediments [Haug et al., 2003] notes the same dry period as Hodell et al. [1995] and notes that the Mayan expansion was over the period 550–750 AD, i.e. just over the first half of Plimer's 'terrible' Dark Age period.

MWP

- 239** As noted above [Grove, 1988] gives only one (Central England) temperature series and does not support the claim of 'widespread' for which it was cited.
- 240** The Broecker [2001] paper discussed above, is an overview rather than a detailed analysis of particular temperatures. Plimer cites it in respect of California 'enjoying warm times'. The actual words in Broecker's paper are 'late in the Medieval Warm Period, California experienced several decade-long periods of profound drought.' (Broecker is citing [Stine, 1994], Plimer's reference 283.)
- 245** The work by Hormes et al. [2001] documents eight periods of Holocene glacial recession in the Swiss Alps, the most recent being 1530–1170 BP (420–780 AD)⁴⁹, interpreted as lagging about 100 years behind temperatures, giving anomalous warmth in the supposedly cold dark ages.

⁴⁹Assuming the standard radiocarbon convention BP = years pre-1950.

266 Verschuren et al. [2000] is cited by Plimer when saying ‘the rise of great Zimbabwe coincided with the beginning of the dry little ice age while a warm pulse in the 15th and 16th centuries created the conditions for mixed farming in the highveld. Another warm and wet period at the end of the 18th century contributed to the spread of maize, increased populations and more military action.’

The actual wording by [Verschuren et al., 2000] is ‘equatorial east Africa was generally drier than today during the Mediaeval Warm Period (MWP; ,AD 1000 to 1270), and that fairly wet conditions during the Little Ice Age (LIA; ,AD 1270 – 1850) were interrupted around AD 1380 – 1420, 1560 – 1620 and 1760 – 1840 by episodes of persistent aridity more severe than any recorded drought of the twentieth century.’

274 These temperature reconstructions from China show swings of up to $\pm 1^\circ$ C either side of the 2000 year mean, and no indication of a Roman warming 2 to 6 degrees warmer than present.

278 Daniels and Knox [2005] look at alluvial deposits on the US Great Plains. They do not obtain any temperature data, but conclude that the drought at the time of the MWP may be an analogue for potential changes from 21st century warming.

LIA

281 ‘The Ontario forests have ... not returned to the diversity and productivity of the Medieval warming.’ Indeed — Campbell and McAndrews [1993] note that ‘the wild forest of Southern Ontario, now largely cleared, is no longer a major carbon reserve ...’

The main results of reference 281 (repeated as reference 286) are model simulations.

Some of the references confirm the widely accepted view of MWP to LIA change in the North Atlantic area, e.g.

350 Lassen et al. [2004] analyses fjord sediments off Greenland, identifying changes, particularly from MPW to LIA as potential contributions to loss of Norse settlements.

Twentieth century

In spite of the importance of current changes, this section of *Heaven + Earth* only cites two references:

368 Plimer correctly quotes this reference as saying ‘climate sensitivity greater than 1.5° C has been a robust feature of the Earth’s climate over the last 420 million years.’ This is in accord with mainstream climate science and **totally contradicts the main thrust of Plimer’s book.**

369 Mann et al. [1998] are cited (incorrectly as noted below) primarily as a lead-in to the following section.

The ‘Hockey Stick’

The term ‘hockey stick’ refers to the climate reconstruction, produced by Michael Mann and colleagues and featured in the 2001 IPCC report. This was criticised by McIntyre and McKittrick on methodological grounds. In response to requests from US legislators the ‘hockey stick’ analysis was reviewed by two expert panels. Although considerable partisanship was involved in establishing the panels, the core mathematical conclusions of the panels are essentially the same.

The Hockey Stick temperature reconstruction by Mann Bradley and Hughes has come under intense criticism and Plimer repeats much of this in attacking the [Mann et al., 1998] paper (footnotes 369 and 372), repeatedly calling Mann et al. ‘fraudulent’. What is surprising is that all this invective is focused on the wrong paper — [Mann et al., 1998] is not the source of the data used in the IPCC hockey stick plots. Mann et al. [1998] is a global analysis (c.f. northern hemisphere in IPCC report) and only covers 600 years (c.f. 1000 years in IPCC report). *Heaven + Earth* only cites the actual hockey stick paper much later as reference 1604, and misrepresents it as referring to sea-level.

For the most part, my criticisms of *Heaven + Earth* address the issue of whether Plimer has exaggerated the conclusions of the more critical of the reports, i.e. the Wegman report [Wegman et al., 2006].

Since the time that version 2.1 was released, the Wegman report has come under serious criticism. This has been summarised in the report *Strange Scholarship on the Wegman Report: A facade for the climate anti-science campaign* by John Mashey. Some of the key claims in the report (obtainable from the deepclimate website) are:

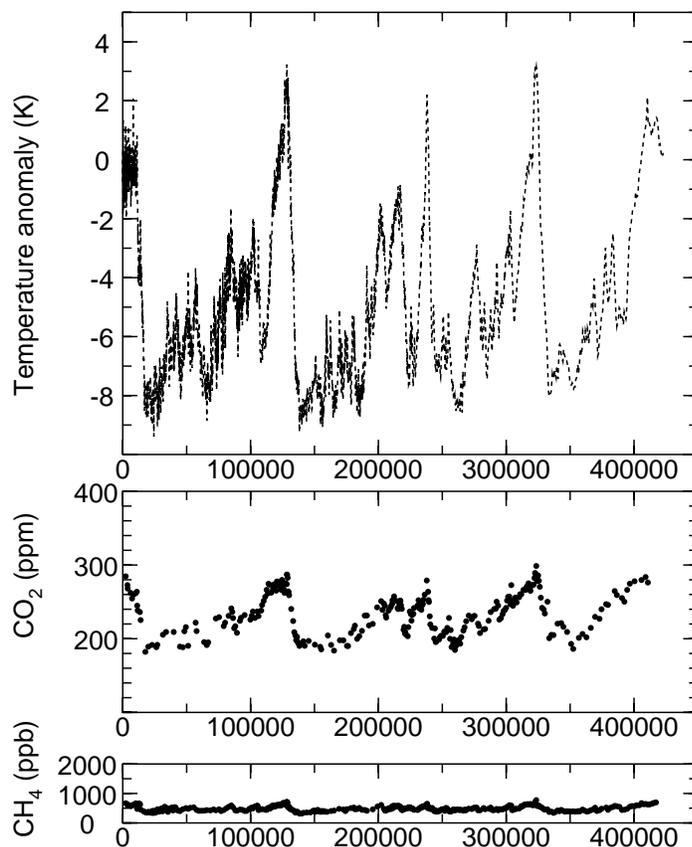
- the process of assembling the report was an orchestrated political campaign (as implied by Mashey’s subtitle);
- much of the Wegman report is plagiarised (sometimes with distortion), including plagiarism from wikipedia;
- there are additional mathematical distortions.

These are serious concerns, but my focus here remains on whether Plimer has misrepresented what Wegman et al. actually wrote.

Plimer usually settles for describing the ‘hockey stick’ as *infamous*. However, on a number of occasions he explicitly describes it as *fraud*, a charge not sustained by either of the expert reviews. Plimer’s claim that the IPCC knowingly included results that were known to be wrong, is disproved by comparing his account on page 91 with what is actually in the IPCC reports [see item 32].

The Vostok ice core

The diagram (from *Twisted ..*) shows the measured CO₂ and CH₄ concentrations measured from air bubbles trapped in the Vostok ice core, along with temperatures estimated from the isotopic composition of the ice.⁵⁰



Temperatures, CO₂ concentrations and methane concentrations from the Vostok ice core. The horizontal axes are in years before present. Graphic from *Twisted: The Distorted Mathematics of Greenhouse Denial* (figure 27). The vertical scales of the concentration curves are in approximate proportion to the amount of warming expected from each gas in the absence of feedbacks between climate and gas concentrations. These should be taken as indicative — the main uncertainties are in the value of the climate sensitivity used to scale the curves and the global representativeness of the estimated temperatures.

The abstract of 1987 paper on this data (back when the analysis only reached back to the previous interglacial) said *Vostok climate and CO₂ records suggest that CO₂ changes have had an important climatic role during the late Pleistocene in amplifying the relatively weak orbital*

⁵⁰Petit, J.R., et al., 2001, Vostok Ice Core Data for 420,000 Years, IGBP PAGES/World Data Center for Paleoclimatology (NOAA/NGDC Paleoclimatology Program, Boulder CO, USA). Data Contribution Series #2001-076. <http://www.ncdc.noaa.gov/paleo/icecore/antarctica/vostok/vostok.html>

forcing. The existence of the 100-kyr cycle and the synchronism between Northern and Southern Hemisphere climates may have their origin in the large glacial-interglacial CO₂ changes. [Genthon et al., *Nature*, **329**, 414–418 (1987)].

This interpretation essentially reflects the mainstream climate science interpretation over the ensuing decades: the climate CO₂ connection is that of a feedback loop with CO₂ changes **amplifying** the effects of changes in insolation due to orbital changes. The reasons for regarding this as a two-way interaction rather than direct causality in either direction are:

Why CO₂ changes are not the sole cause of ice ages:

i: The gas changes are too small. In preparing the diagram for *Twisted...* I followed a suggestion from the *RealClimate* website and plotted the concentration curves in proportion to the expected temperature changes.

ii: There are no plausible mechanisms for linking concentrations to orbital changes, except via climate changes over large regions.

Why orbital changes are not the sole cause of ice ages::

iii: The changes in insolation are too small:

iv: Many of the insolation changes act with opposite signs in the two hemispheres and so the approximate hemispheric synchronisation is hard to account for except through an amplifying factor (such as greenhouse gas concentrations) that is common to both hemispheres.

Thus having concentration changes lag behind temperature is entirely to be expected under this mainstream view, while the opposite result would have been extremely difficult to account for.

In addition to the reasons noted above:

v: the abrupt nature of the deglaciation, unlike the smooth variations in orbital forcing, points to ‘tipping point’ behaviour characteristic of a non-linear coupled system.

Al Gore’s book largely ducks the issue and calls the relation *complicated*.⁵¹

The IPCC

Plimer’s overall approach to the IPCC reports is one of “shoot the messenger”. This attack involves extensive misrepresentation of the content of the IPCC reports [items 10, 11, 29, 32, 93, 97, 100, 109, 110, 111, 118].

One aspect of the IPCC reports that Plimer repeatedly misrepresents is the authorship of the chapters. The IPCC’s instructions on how chapters should be cited give a specific definition of authorship, i.e. those who should get the credit (or take the blame) for what is in the chapter and who are responsible for addressing review comments. These are those people listed as ‘lead authors’ and ‘convening lead authors’. These people are characterised by Plimer as *scientists and environmental extremists* [page 98] without actually naming any people in the latter category.

There have been two errors identified in the 2007 IPCC assessment

- an incorrect claim about melting of Himalayan glaciers

⁵¹In the interests of precision and ability to check issues, I mainly work with the book version of *An Inconvenient Truth*. My recollection is that the content of the book (i.e. excluding the preface) and film are very similar apart from the film’s early line *I used to be “The next president of the United States”*, and, of course, the stunt with the hoist.

- an incorrect claim that 55% of the Netherlands is below sea level. (on p303 Plimer says 40%)

In addition, an interagency report into the IPCC processes and procedures has identified a need for greater consistency in the terminology used for uncertainty across the three IPCC working groups.

Summing up

Ian Plimer's claim that the human influence on climate can be ignored, relative to natural variations seems to rest on three main strands of argument:

- a:** the extent of natural variability is larger than considered in 'mainstream' analyses;
- b:** the effects of changes in radiative forcing are smaller than values used in 'mainstream' analyses;
- c:** the IPCC uses a range of misrepresentations to conceal points **a** and **b**.

The most obvious point to note is that if there was a valid case to be made for any of these claims, then there would have been no need for Plimer to resort to systematic misrepresentation.

a: The extent of natural variability is being misrepresented, particularly through an exaggerated emphasis on the Medieval Warm Period (MWP). The cited references for large-scale Medieval warming fail to support the claim and in several of these cases seem not to mention Medieval warming at all — [items 21, 23, 123]. The one reference that seems most relevant to global-scale changes (at least over land) is the paper on the borehole data [footnote 256]. The quote from this paper is selective and inaccurate [see item 24]. The main results of the paper indicate MWP temperatures higher by 0.1 to 0.5°C, rather than the 2 to 3°C claimed by Plimer [item 24].

b: The effect of radiative forcing is being misrepresented by repeated claims of a climate sensitivity of 0.5°C [items 69, 73, 120] even when Plimer's own examples show climate sensitivities of 1.5°C to 1.6°C [item 104], his denial of an effect beyond 400 ppm [items 74, 75] even when he acknowledges the logarithmic relation [page 338] and presents a graph [figure 50] consistent with that relation [item 75].

The human contribution to changes in the Earth's radiation balance are extensively misrepresented through misrepresentation of CO₂ measurements and misrepresentation of carbon exchanges.

c: For the IPCC there is extensive misrepresentation of:

- the content of the IPCC reports [items 10, 11, 29, 32, 93, 97, 100, 109, 110, 111, 118];
- the operation of the IPCC assessment process and the authorship of reports [items 150, 109]; and
- the characteristics of climate models that form the basis of some of the science presented in the IPCC reports [items 49, 68, 121].

In support of these three main strands of argument are presented extensive references, many of which either fail to support the claims [items 21, 23, 24, 44, 46, 90, 123]; explicitly contradict the claims [items 76, 77, 84, 100]; are irrelevant to the claims [items 81, 116]; or otherwise misrepresent the cited reference.

In addition the various misrepresentations of the IPCC and the content of IPCC reports in *Heaven + Earth*, the introduction above noted:

- it has numerous internal inconsistencies [items 66, 98] as well as the inconsistencies noted above regarding climate sensitivity;
- in spite of the extensive referencing, key data are unattributed, particularly for the graphics, and the content of references is often mis-quoted [items 46, 84]. Simply citing entire books (or entire IPCC reports) for a specific point, without giving section or page numbers does not reflect a well-referenced book.

Finally, as well as the inconsistencies and misrepresentations there are also a modest number of minor errors that should ideally have been picked up by adequate editing. Some errors in referencing are noted on page 32. The confusing of ‘absorbs’ and ‘adsorbs’ is noted in items 62, 73 and 94. On page 299, ‘interannular’ should be ‘interannual’. Furthermore, the editing process should have detected the various problems identified in item 3 to do with labelling of axes. Probably a careful editor would have removed most of the things identified in the section on ‘Silly Stuff’ [items 157 to 164].

Acronyms and abbreviations

ABC Australian Broadcasting Corporation.

AGW Anthropogenic Global Warming.

AR4 Fourth Assessment Report (of the IPCC).

BP Before present. There is a convention in the radiocarbon dating community that ‘years before present’ is fixed at ‘years before 1950’.

CDIAC Carbon Dioxide Information and Analysis Center. (Oak Ridge, USA).

DA Dark Ages.

ETS Emissions Trading Scheme.

GISS Goddard Institute for Space Studies.

GC Gas chromatograph(y). An instrument/technique used to measure greenhouse gases (and many other things).

GGWS The Great Global Warming Swindle.

GtC Gigatonnes of carbon. One gigatonne is one billion (10^9) tonnes.

IPCC Intergovernmental Panel on Climate Change.

IRGA Infra-red gas analyser.

LIA Little Ice Age.

MSU Microwave Sounding Unit. Instrument for measuring atmospheric temperature from satellites.

MWP Medieval Warm Period.

NASA National Aeronautics and Space Administration. (USA).

NOAA National Oceanic and Atmospheric Administration. (USA).

RW Roman Warming.

SAR Second Assessment Report (of the IPCC).

SPM Summary of Policy Makers, i.e. summary of an IPCC report.

TAR Third Assessment Report (of the IPCC).

TS Technical Summary, i.e. summary of an IPCC report.

UAH University of Alabama, Huntsville.

WDCGG World Data Centre for Greenhouse Gases. (JMA, Japan).

WG1 Working Group 1 (of the IPCC).

Version history

Typeset March 23, 2011

The intention is that the published URL shall always refer to the most recent version of this document.

There have been minor variations on the structure of the page-by-page analysis. From versions 1.5 onwards, sections on ‘conduct of science’ and ‘silly stuff’ have been kept separate. From version 2.0 onwards, a section on ‘cherry-picking’ has been included. The current version is: Version 2.2, with my itemised and indexed discussion of 126 items and a number of other contributed items giving a total of 143.

The various versions (with approximate times of availability) have been:

- Version 2.1 which introduced specific section on plagiarism with a total of 134 ‘science’ points, 29/1/2010
- version 2.0 with a total of 123 science items and the introduction of the cases of ‘cherry-picking’, MASCOS 13:45, 3/9/2009.
- Version 1.9 with a total of 106 ‘science’ items, MASCOS 12:00, 29/6/2009.

- Version 1.8 with a total of 96 ‘science’ items, MASCOS 15:10, 9/6/2009.
- Version 1.7 with a total of 92 ‘science’ items, MASCOS 09:00, 2/6/2009.
- Version 1.6 with a total of 77 ‘science’ items, MASCOS 16:00, 25/5/2009.
- Version 1.5 with a total of 61 items concerning the science with additional discussions relating to conduct of science (and some silly stuff) split off from the main discussion. MASCOS 08:17, 22/5/2009.
- Version 1.4, with my itemised and indexed discussion of 46 items and other contributions bringing the total to 58 (plus comments on some silly stuff): about 18:00 on 16/5/2009 (BNC site) and about 10:40, 18/5/2009 (MASCOS).
- Version 1.3, with itemised and indexed discussion of 40 of my items and 3 other contributions: 15/5/2009 (BNC site only).
- Version 1.2, with itemised and indexed discussion of 39 items: 14/5/2009.
My letter about this document was published in *The Australian* on 15/5/2009 with the underscore character in the the URL that I sent in my letter replaced by a ‘dash’ in the printed version and a double hyphen in the electronic version. A ‘re-direct’ was established at the University of Melbourne so that the document could be accessed from the published address, but did not deal with the fact that the two forms of publication involved two different incorrect URLs. My posts to the Australian’s letters blog were not accepted.
- Version 1.1, with itemised and indexed discussion of 34 items was uploaded for test purposes about 16:30 13/5/2009, unfortunately resulting in a failed test, with the URL not being preserved (but removing version 1).
- Version 1, with itemised and indexed discussion of 33 items, was submitted to the MASCOS website on 12/5/2009 and available from mid-morning 13/5/2009.

Due to problems on the MASCOS site and the incorrectly published links in *The Australian*, various versions were mirrored on the *Brave New Climate* website.

- version 1.9: 13:00, 29/6/2009;
- version 1.8: 01:10, 10/6/2009;
- version 1.7: 17:50, 1/6/2009;
- version 1.6: 21:30, 25/5/2009;
- version 1.5: 01:45, 22/5/2009;
- version 1.4: at about 18:10, 16/5/2009;
- version 1.3: late on evening of 15/5/2009;
- version 1.2: on 14/5/2009;
- version 1.1: from about 21:00, 13/5/2009.

Response to criticism of my analysis

A number of these criticisms come from the letters blog of *The Australian*. Since *The Australian* did not accept my posts of replies, even when I kept my comments separate from the URL issue, a few short comments are given here:

Why didn't I attack Al Gore in the same way?

i: I wasn't engaged in public debate until early 2007 when I started writing *Twisted: The Distorted Mathematics of Greenhouse Denial*.

ii: Plimer claims to be writing as a scientist and his op-ed *Hot-air doomsayers* (5/5/2009 in *The Australian*) challenges scientists to address the science. I am taking him at his word. As noted above, *Heaven + Earth* is being promoted as a *scrupulous and scholarly analysis*.⁵² Gore is a politician and *An Inconvenient Truth* is largely a political book, arising from the difficulties of responding to 'politically-inconvenient' science.

iii: Even if one thinks that Justice Burton was wrong and one accepts all the errors claimed in the UK court case, Gore's book has many fewer scientific errors than *Heaven + Earth*. (This assessment was based on my own notes. Earlier versions, 1 to 1.3, did not document enough of the errors in *Heaven + Earth* to demonstrate that claim.)

Item 3 above lists errors in the graphics in *An Inconvenient Truth*.

Concentrating on Plimer's inconsistencies is nit-picking that doesn't address scientific issues

A theme that I tried to get across in *Twisted* is that for a scientific theory, a lack of internal consistency is even more fatal than discordant observations. Thus, to the extent that Plimer claims to be proposing an alternative theory⁵³, his own lack of consistency becomes an issue of science and not just an issue of editorial quality.

My literal interpretation of 'IPCC computers' (in item 150) is disingenuous (or silly)

Part of Plimer's 'shoot the messenger' attack on the IPCC is to portray it as a corrupt 'bogey-man'. Creating a bad impression about something that exists only in Plimer's (and others') imagination frees him for nasty constraints like facts. In talking about 'IPCC models', 'IPCC climate models' or 'IPCC climate modellers' he is talking about something that doesn't actually exist. The IPCC doesn't:

- run climate models,
- develop climate models, or
- fund climate models.

When Plimer adopts this approach of criticising something that doesn't really exist, I go for closest meaning — presumably the one he is hinting at. Mislabelling the models as 'IPCC models' gives him a two-fold attack — he not only misrepresents the content of the models, but by mis-attributing them he also links them to his various misrepresentations of the IPCC (see page 49). However, unlike 'IPCC climate models', 'IPCC computers' really do exist and so rather than interpret an indirect implication (which is done elsewhere), I interpret his actual words. The real issue is Plimer's bogey-man approach — it is of course nice and safe — you

⁵²From cover blurb on paperback edition, by Lord Lawson of Blaby.

⁵³as opposed to spreading doubt and confusion for political purposes

can say all sorts of nasty stuff about a group that doesn't exist — since the group doesn't exist, they won't sue you.

Checking my claims

If you can't accept the assessments of the IPCC after all the care and detailed review, then there it would seem unlikely that you would take my word for the claims above without checking.⁵⁴ The selection of flaws described in this document is intended to maximise the extent to which individuals can check my claims for themselves.

Plimer's inconsistencies: Here the only resource that you need is a copy of *Heaven + Earth*, and maybe a calculator (or a spreadsheet). This will allow you to check the claims that I make in items 31, 40, 47, 56, 66, 70, 88, 98, 101 and the various inconsistent values for climate sensitivity discussed in items 69, 73, 75, 104, 120, 124.

Other flaws: Similarly, a copy of the book is all that is need to check various graphics flaws such as axis labelling, [see item 3 for summary] and things such as items 8, 27, 33, 37, 40, 42, 48, 74 (with the aid of a good dictionary) as well as most of the things in the section on 'Silly Stuff' (page 31).

Plimer's misrepresentation of the IPCC: Many of these are easily checked, since the full Third and Fourth Assessment Reports are available as downloads from the IPCC website. A figure such as 8.20 indicates a figure in chapter 8 (with TS indicating the Technical Summary). This will enable you to check (at least in part) items 10, 11, 12, 32, 93, 30, 100, 109, 110, 111. Checking items 29, 97 requires obtaining access to one or both of the first two assessments as do some aspects of items 32, 93, 110, 123.

Using other internet resources: Most of the data sets discussed in this document can be freely accessed.

- The various HadCRU temperature data sets are available from:
<http://www.cru.uea.ac.uk/cru/data/temperature/>
This will enable you to check items 6, 14, 83, and (with reference to IPCC report to verify my identification of the data set) 118.
- The plot, http://cdiac.ornl.gov/trends/co2/graphics/Mauna_Loa_CO2.jpg, from the Carbon Dioxide Information and Analysis Center (CDIAC) shows that at the primary repository for these data, the gaps in the Mauna Loa data set have not somehow mysteriously disappeared — item 89.
- <http://arctic.atmos.uiuc.edu/cryosphere/IMAGES/global.daily.ice.area.withtrend.jpg> will show that the lower plot in figure 29 is not what Plimer claims [item 54].

In addition:

⁵⁴After all, I have been a lead author of an IPCC chapter.

- <http://www.bailii.org/ew/cases/EWHC/Admin/2007/2288.html> is the judgment in the UK court case on *An Inconvenient Truth*, enabling you to check item 113⁵⁵.

Library references: A number of Plimer's references are to books and journals that are only found in specialist libraries. However the journals *Science* and *Nature* are quite widely available and so much of my checking of references in *Heaven + Earth* has concentrated on these journals.⁵⁶

Access to *Nature* will enable you to check ⁵⁷ references 17, 18 [item 7], 2056 [item 84], 2134 [item 102].

Access to *Science* will enable you to check references 255 [item 23], 595 [item 41], 1075 [item 46], 1682 [item 61], 1738 [item 63], 1990 [item 78], 2009 [item 82], 2123* [item 99], 2178 [item 112].

Other journal access Some scientific journals make older material freely available on-line. In addition, a number of journals allow authors to post copies of their articles on their personal web-sites.

Acknowledgements

This analysis draws on the work of various colleagues. Many errors in *Heaven + Earth* were brought to my attention by Barry Brook, A.B. Pittock, A.J. Guttman, Michael Ashley, Tim Lambert, Steven Sherwood, Kevin Hennessy, Colin Allison, David Karoly and Penny Whetton. This input is acknowledged by initials after various items. Generally this does not cover cases where several of us have independently noted the same flaw. My grateful thanks for this input should not be taken as implying that they agree with every detail of how I have discussed the concerns that they identified. Thanks to Jeremy Mates for sending in editorial comments. Item 13 includes a comment from the *Brave New Climate* website. Particular thanks are due to Richard Brak who organised a 're-direct' when *The Australian* inserted an extra dash in the URL that I sent them.

Disclaimer

This discussion, its contents and style, are the responsibility of the author and do not represent the views, policies or opinions of The University of Melbourne.

References

Ernestina Badal, Joan Bernabeu, and Jean Louis Vernet. Vegetation changes and human action from the Neolithic to the Bronze Age (7000-4000 B.P.) in Alicante, Spain, based on charcoal analysis. *Vegetation history and archeobotany*, 3:155–166, 1994.

⁵⁵As noted in connection with item 113, version 2.1 gave an incorrect URL.

⁵⁶A * after the reference number indicates that this reference is the same paper as one earlier in the list.

⁵⁷In version 1.9, several citations of papers in *Science* were incorrectly listed in this section as being in *Nature*.

- M. G. L. Baillie. Dendrochronology raises questions about the nature of the AD 536 dust-veil event. The Holocene, 4:212–227, 1994.
- Wallace S. Broecker. Was the Medieval Warm Period Global? Science, 291(5508):1497–1499, 2001. doi: 10.1126/science.291.5508.1497. URL <http://www.sciencemag.org/content/291/5508/1497.short>.
- N. Caillon, J. P. Severinghaus, J. Jouzel, J. M. Barnola, J. Kang, and V. Y. Lipenkov. Timing of atmospheric CO₂ and Antarctic temperature changes across termination III. Science, 299: 1728–1731, 2003. only analyses one termination.
- I. D. Campbell and J. H. McAndrews. Forest disequilibrium caused by rapid Little Ice Age cooling. Nature, 366:336–338, 1993.
- D. Dahl-Jensen, K. Mosegaard, N. Gundestrup, G.D. Clow, S.J. Johnsen, A.W. Hansen, and N. Balling. Past temperatures directly from the Greenland ice sheet. Science, 282:268–271, 1998. No mention of CO₂ CH₄.
- J. M. Daniels and J. C. Knox. Alluvial stratigraphic evidence for channel incision during the mediaeval warm period on the central Great Plains, USA. The Holocene, 15:736–747, 2005.
- J. M. Grove. The Little Ice Age. Methuen, 1988. Mis-rep on widespread MWP.
- Gerald H. Haug, Detlef Günther, Larry C. Peterson, Daniel M. Sigman, Konrad A. Hughen, and Beat Aeschlimann. Climate and the collapse of Maya civilization. Science, 299:1731–1735, 2003.
- D. A. Hodell, J. H. Curtis, and M. Brenner. Possible role of climate in collapse of classic Maya civilisation. Nature, 375:391–394, 1995.
- A. Hormes, B. U. Müller, and C. Schlüchter. The Alps with little ice: evidence for eight Holocene phases of reduced glacier extent in the Central Swiss Alps. The Holocene, 11: 255–265, 2001.
- H. Lamb. Climate, History and the Future. Methuen, 1977. Misrepresented on Roman Warming — actually says ‘it may have been warmer than now’.
- K. Lambeck et al. Sea level in Roman time ... Earth Planetary Sci. Lett., 224:563–575, 2004.
- Susanne J. Lassen, Antoon Kuijpers, Helmar Kunzendorf, Gerd Hoffmann-Wieck, Naja Mikkelsen, and Peter Konradi. Late-Holocene Atlantic bottom-water variability in Igaliku Fjord, South Greenland, reconstructed from foraminifera faunas. The Holocene, 14:165–171, 2004.
- S. M. Lebreiro et al. Climatic change and coastal ... The Holocene, 16:1003–1015, 2006.
- M. E. Mann, R. S. Bradley, and M. K. Hughes. Global-scale temperature ... Nature, 397: 779–787, 1998.

- M. Retti-Shati et al. A 3000 year climate record. Science, 281:980–982, 1998. 4200 to 1200 BP - not linked to modern temperatures.
- A. V. Reyes et al. Expansion of alpine glaciers in Pacific North America in the first millennium A.D. Geology, 34:57–60, doi: 10.1130/G21902.1, 2006.
- D. L. Royer et al. Climate sensitivity constrained by CO₂ ... Nature, 446:530–532, 2007.
- S. Stine. Extreme and persistent drought Nature, 369:546–549, 1994.
- Dirk Verschuren, Kathleen R. Laird, and Brian F. Cumming. Rainfall and drought in equatorial east Africa during the past 1,100 years. Nature, 403:410–413, 2000.
- E. J. Wegman, D. W. Scott, and Y. H. Said. Ad hoc committee report on the ‘hockey stick’ global climate reconstruction. http://republicans.energycommerce.house.gov/108/home/07142006_Wegman_Report.pdf, 2006.

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